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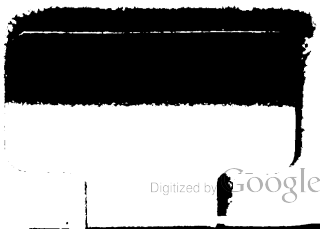
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ROYAL AIR FORCE.

TECHNICAL NOTES

AEROPLANES

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NOTE.

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ROYAL AIR FORCE

TECHNICAL NOTES.

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1918

RIGGING NOTES.

Emanuel Fritz
Capt. Air Service.

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TECHNICAL NOTES.

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RIGGING.

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Nieuport Two Seater (130 H.P. Clerget).

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Spad Biplane. [Type, S.VII.] (150 H.P. Hispano-Suiza).

Vickers F.B.9 (100 H.P. Monosoupape).

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MARTINSYDE SCOUT.

[1] G.100 120 H.P. BEARDMORE.

[2] G.102 160 H.P. BEARDMORE.

RIGGING NOTES

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MARTINSYDE SCOUT.

(1) G.100 120 H.P. BEARDMORE.
(2) G.102 160 H.P. BEARDMORE.

MANUFACTURER'S ORDER OF ERECTION.

1. Fuselage assembled.
2. Fuselage trued up.
3. Undercarriage fitted.
4. Engine bearers fitted.
5. Centre section struts fitted.
6. Seat and control unit fixed.
7. Main and oil tanks fitted.
8. Control guides fitted and fuselage covered.
9. Air and petrol pipes and engine fitted.
10. Centre plane and gun mounting fitted.
11. Tail plane, wings, etc., fitted.
12. Cowls fitted.

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MARTINSYDE SCOUT.

[1] G.100 120 H.P. BEARDMORE.

[2] G.102 160 H.P. BEARDMORE.

TRUING UP THE FUSELAGE.

(*a*) With Fuselage true and in Flying Position it is symmetrical in plan view throughout.

(*b*) The Engine Bearers and the Spars at the bottom of the Fuselage are level.

(*c*) The Top Longerons are level throughout.

(*d*) The Front Side Struts and all Side Struts in rear of pilot's seat are vertical.

To true up, support the Fuselage on two trestles, one placed near the Rear Spar at bottom of Fuselage, and the other under the Tail.

Pack up the Supports so as to level the Bottom Front Spar and the Top Longerons as far as possible.

Before any truing up is attempted, it is necessary to ensure that Strut Sockets are accurately spaced along the Longerons, and particularly that corresponding consecutive Sockets on both sides are equally spaced; also that all Struts are cut accurately to length.

Working from front to rear, adjust Internal Cross Bracing Wires, making corresponding diagonals equal at each section, and check by trammel all through.

Adjust Top Cross Bracing Wires, making corresponding diagonals equal in each bay, and check by trammel all through. A centre line stretched from the *Axis* of the Finpost to the mid point of the Front Top Cross Strut should cut the mid points of all Top Cross Struts. Check by try square at each mid point. The base of try square should be along the Strut, and the marked point on one edge of the blade. The top stretched centre line should *just touch the same edge* of the blade.

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Martinsyde Scout (120 H.P. and 160 H.P. Beardmore)—continued.

Proceed similarly for the Bottom Cross Bracing Wires, carefully trammelling each bay in turn.

Mark points on Side Struts at equal vertical distances—5" is a convenient distance—below the *top* face of the Top Longerons.

True up the Side Bracing Wires on one side until all marked points on Side Struts on that side are in line.

Check by levelling from marked point to marked point on adjacent Struts. Proceed in exactly the same way for the other side.

Check for there being no twist in the Fuselage as follows:—

Place a straightedge transversely across the Top Longerons above the Front Spar at bottom of Fuselage. Place another straightedge transversely across the Top Longerons at any other point about 2½" from Strut Sockets.

The upper edge of the second straightedge should be in line with the upper edge of the first straightedge.

Check by sighting, and repeat for other points.

A plumb line dropped from the mid point of a Top Cross Strut should strike the mid point of the corresponding Bottom Cross Strut.

Throughout the process of truing up the Engine Bearers and Bottom Front Spar should be level and remain level.

NOTE.—It is very important that all Tie Rods be cut accurately to length; otherwise it will be impossible to get the Fuselage true.

TRUING UP THE UNDERCARRIAGE.

Adjust Front Cross Bracing Wires, making corresponding diagonals equal, and check by trammel.

PLACING THE MACHINE IN FLYING POSITION.

Before truing up the Centre Section and attaching and truing up the Main Planes it is necessary to get the Machine in Flying Position.

To do this block the Machine up under the Undercarriage Struts and support the Tail on a trestle placed near the Sternpost.

The Machine is in Flying Position when the Engine Bearers are level longitudinally, and Front and Rear Spars at bottom of Fuselage are level transversely.

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Martinsyde Scout (120 H.P. and 160 H.P. Beardmore)—continued.

Make transverse adjustments by packing blocks under the Undercarriage Struts, and make longitudinal adjustments by raising or lowering the Tail.

TRUING UP THE CENTRE SECTION.

The Centre Section Struts G.A. 41 Front and G.A. 40 Rear (as marked on the side of the Struts about halfway along) are bolted to the Top Longerons.

Before fitting the Upper Centre Section Plane place it upside down on trestles and fix and split-pin all Centre Section Bracing Wires.

To fit the Upper Centre Section Plane bolt it in position on the Centre Section Struts and loosely connect up the Bracing Wires.

The Side Bracing and Rear Cross Bracing Wires are Raf- wires, and the front ones are Cables.

The Rear Cross Bracing Wires pass through the Aluminium Deck, and the hands can be passed through the hole used for fitting the Petrol Tank for the purpose of fixing the lower ends.

Care must be taken to fit these Wires right and left as labelled, the right and left being taken from the Pilot's Seat looking forward.

The Centre Section should be symmetrical about the vertical centre line of Machine. Adjust by Front Cross Bracing Cables and Rear Cross Bracing Wire, making corresponding diagonals equal, and check by trammel.

The Stagger of the Centre Section should be 18". Adjust by Side Bracing Wires and check by measuring the horizontal fore and aft distances between the leading edge of Lower Centre Section Planes and plumb lines dropped from the Leading Edge of Upper Centre Section Plane.

ATTACHING THE MAIN PLANES.

Fit and split-pin the Landing Wires of the Inner Bays to the tops of the Centre Section Struts.

The Main Planes are assembled with their Leading Edges on the ground, and the whole lifted into position, secured to Spars of the Centre Section Planes, and the Landing Wires in the Inner Bays loosely connected.

The Spars of the Main Planes are secured to the Spars of the Centre Section Planes by means of Securing Rods, which are inserted from the front and are each locked in position by two clips and a Split Pin about 2½" from the Leading Edges.

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Martinsyde Scout (120 H.P. and 160 H.P. Beardmore)—continued.

The Flying Wires are then fitted and locked to their correct lengths, and should not require further adjustment.

TRUING UP THE MAIN PLANES.

The *Dihedral* is 2° for both Upper and Lower Main Planes. Adjust by Front Landing Wires and check by Abney Level and straightedge along the Front Spars.

A taut chord stretched above the Upper Main Planes over the line of the Front Spars, from the top of Port Outer Strut to the top of the Starboard Outer Strut should be $5\frac{1}{16}$" vertically above the Upper Centre Section Plane Front Spar. Check at lateral extremities of the latter.

The *Stagger* is 18" throughout. Adjust by Incidence Wires and check by measuring the horizontal fore and aft distance between the Leading Edge of Lower Main Planes and plumb lines dropped from the Leading Edge of Upper Main Planes.

The *Incidence* is 3° throughout for both Upper and Lower Main Planes. Adjust by Incidence Wires and Rear Landing and Flying Wires, and check by Abney level and straightedge, placing the latter from Leading Edge to Trailing Edge at Ribs.

Check for Main Planes being square with Machine by taking measurements from Top and Bottom Sockets of Front Outer Struts to Front Drag Wiring Plates and Rudder-post. Corresponding measurements should be the same on both sides.

After truing up the Main Planes connect up the Drag Cables.

FIXING THE EMPENNAGE.

The Tail Plane is fixed to the Tail of the Fuselage by means of two 8mm. Bolts, which project from the tops of the Top Longerons, and two 8mm. Bolts, which project from the Rear Spar of the Tail Plane. The Front Spar is held down by four 8mm. Nuts, two of which act as Lock Nuts; the Rear Spar is secured in position by two 8mm. Castle Nuts and Split Pins. The Tail Plane Bracing Rods, which are not adjustable, govern the position of the Tail Plane with regard to the Main Planes.

The Fin fits over the Tail Plane, and is held in Front by two Clips which project through the Fabric. At the rear end the Fin Post projects right through the Fuselage, and is secured by a Castle Nut and Split Pin under the Plate at the bottom of the Fuselage.

After fitting the Fin connect up the Tail Plane Bracing Wires. Adjust the latter so that the Tail Plane is level transversely and square with Machine.

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Martinsyde Scout (120 H.P. and 160 H.P. Beardmore)—continued.

Check the former by spirit level over the Spars, and check the latter by measuring the distance from Bottom Sockets of Rear Outer Struts to lateral extremities of Rear Spar of Tail Plane. Corresponding measurements should be the same on both sides.

The Fin should point directly fore and aft and be square with Machine.

Hinge the Rudder and Elevators in position by means of the Hinge Rods, and secure the latter by Split Pins.

CONTROLS.

With Pilot's Control Stick central transversely, the Ailerons should be in continuation of Tail Plane.

With top of Pilot's Control Stick 6″ in rear of Top Cross Strut immediately in front of Pilot's Seat, the Elevators should be in direct continuation of Tail Plane.

With Rudder Bar square in Fuselage, the Rudder and Tail Skid should point directly fore and aft and be square with Machine.

ERRATA.

Page 5, line 5. For "2°" read "$2\frac{1}{2}°$."
Page 5, line 10. For "$5\frac{7}{16}$″" read "$6\frac{1}{2}$″."
Page 6, line 12. For "Tail Plane" read "Main Planes."

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MARTINSYDE SCOUT.

[1] G.100 120 H.P. BEARDMORE.

[2] G.102 160 H.P. BEARDMORE.

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	38′ 0″
Span of Lower Main Planes	38′ 0″
Chord of Upper Main Planes	5′ 11½″
Chord of Lower Main Planes	5′ 11½″
Incidence of Upper Main Planes	3°
Incidence of Lower Main Planes	3°
Stagger	18″
Dihedral	2½°
Overall Length	26′ 6½″
Height	9′ 8″
Wheel Track	6′ 0″
Droop of Ailerons	Nil.

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MARTINSYDE SCOUT.

[1] G.100 120 H.P. BEARDMORE.

[2] G.102 160 H.P. BEARDMORE.

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Leading Edges of the Main Planes are Symmetrical about centre line of Machine.

Examine the Bracing Wires for length and tautness in the Centre Section, and see that the Split Pins are in position, and that all Lock Nuts are tight.

Check the Dihedral of Lower Main Planes.

Check the Stagger.

Check the Incidence.

See that the Interplane Struts are straight.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position.

Examine all Control Pulleys and Cables, see that they work freely, and that Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is set correctly and is square with Machine, that all Tail Plane Bracing Wires are correct both as to tautness and length, that all Split Pins are in position, and that all Lock Nuts are tight.

Examine Rudder and Fin and see that they are set straight and square with Machine.

Measure the setting of the Ailerons and Elevators

Examine Undercarriage and Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories.

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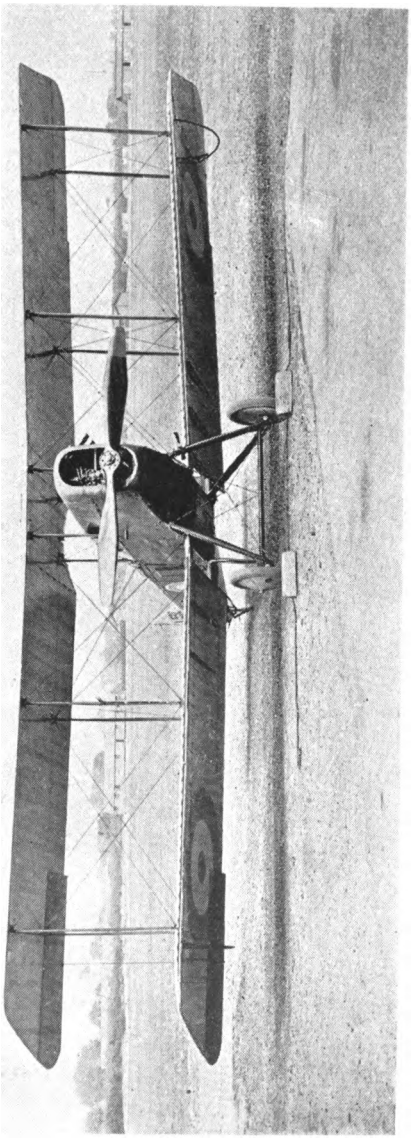
T.5. MARTINSYDE SCOUT. (160 H.P. BEARDMORE.)
FIG. 1.



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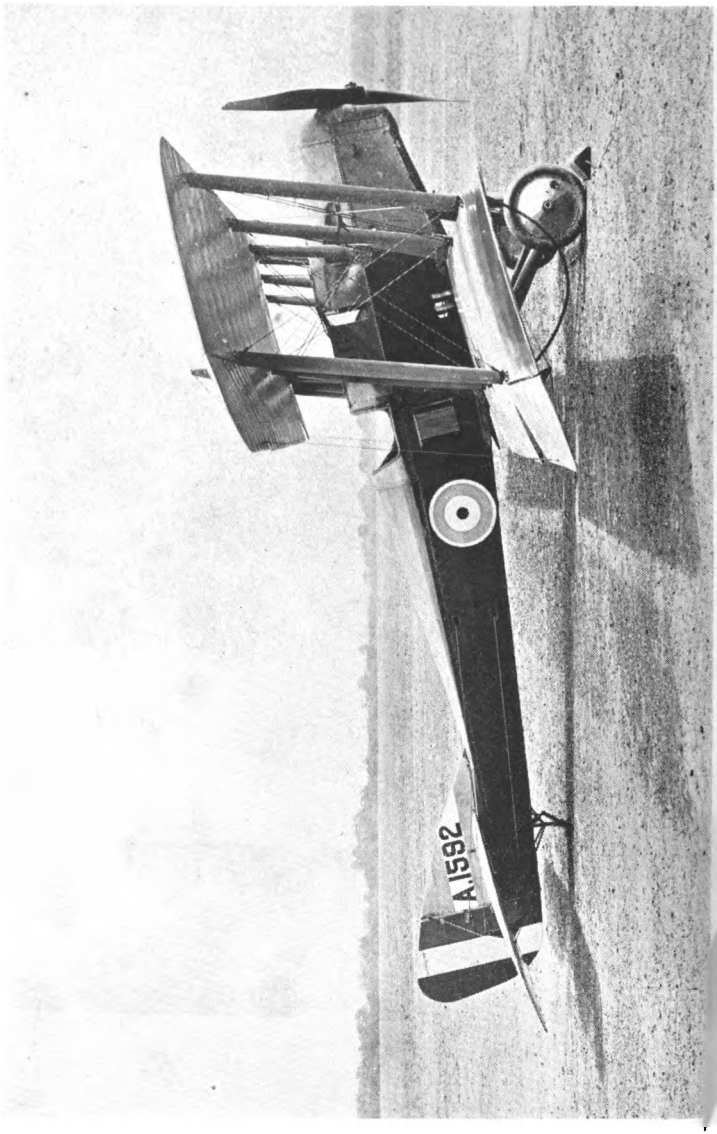
T.5. MARTINSYDE SCOUT. (160 H.P. BEARDMORE.)
FIG. 2.



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MAURICE FARMAN "LONGHORN."

BIPLANE [TYPE 1913] [80 H.P. RENAULT].

RIGGING NOTES.

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MAURICE FARMAN "LONGHORN."

BIPLANE [TYPE 1913] [80 H.P. RENAULT].

MANUFACTURERS' ORDER OF ERECTION.

---

1. Main Cell assembled and Centre Secton trued up. Leading Edges adjusted to be straight in plan view.
2. Nacelle fitted.
3. Undercarriage fitted and trued up.
4. Tail Booms and Empennage fitted and trued up.
5. Main Cell completely trued up with Machine in Flying Position.
6. Front Outriggers and Front Elevator fitted.
7. Empennage trued up with Machine in Flying Position.
8. Controls connected up and adjusted.
9. Engine fitted, all Tank Connections made, and Engine Controls connected.

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MAURICE FARMAN "LONGHORN."

BIPLANE [TYPE 1913] [80 H.P. RENAULT].

ERECTION AND PRELIMINARY TRUING UP MAIN CELL.

Interplane Struts are lettered as follows:—

Rear of Main Cell.
T. S. R. P. N. M. L. K.
A. B. C. D. E. F. G. H.
Front of Machine.

Erect Lower Main Planes, less Ailerons, on low trestles placed *under* Sockets for Struts A. T. C. R. F. M. H. K. Bolt up the Upper Main Plane *complete* with Ailerons and Extensions, and fit Struts A. T. C. R. F. M. H. K. into their *Top Sockets.*

By means of these Struts lift the Upper Main Plane bodily into position, fitting the *bottom end* of the Struts into their Sockets on the Lower Main Plane.

Fit all remaining Struts, and loosely connect all Main Cell Wires.

Connect four temporary Diagonal Wires, two in front and two in rear, at Struts D. E N. P.

TRUING UP THE CENTRE SECTION.

True up the Centre Section until all Centre Section Struts are vertical and the line joining Leading Edges of Upper and Lower Main Planes is at right angles to the *full chord* of the Centre Section, just *outside* Struts C. R. and F. M. Check by means of a large square.

Stretch a line from the *tops* of the Bottom Struts Sockets at C. and F. This line should be 5 mm. below the *tops* of the Sockets at the *bottom* of Struts D. and E.

Next, by means of the Front Interplane Bracing Wires, adjust so that the Leading Edge of the Lower Main Planes is straight in plan view, and all Front Interplane Struts are straight and parallel.

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Maurice Farman "Longhorn."—continued.

Check by stretching a line from the *tops* of Bottom Sockets at Struts A. and H. This line should cut the *tops* of Bottom Sockets at Struts B. C. F. and G., and be 5 mm. below the *tops* of Bottom Sockets at Struts D. and E.

Check for Struts being straight and parallel by aligning them from the side and viewing them from the front.

NOTE.—On all Wires where Turnbuckles occur the threads should be fully engaged in the Barrels.

TRUING UP THE UNDERCARRIAGE.

The Undercarriage should be trued up *before* fitting the Front Outriggers.

Stretch two lines from Leading Edge of Upper Centre Section Plane at Struts C. and F. to the mid points of the junctions of Main and Front Skids.

Adjust the Undercarriage Bracing Wires until Undercarriage Struts on each side are in line, viewed from the front, with their respective overhead Centre Section Interplane Struts, and the distance of the mid points of the Leading Edge at the feet of the latter Struts are 10cms. from the stretched lines.

FITTING THE NACELLE.

Expand the Centre Bay by means of two rods hinged together, the total over-all length of the two being about 1½" greater than the distance between Struts of the Centre Bay. By means of these hinged rods, which are fitted about mid-way between the Leading Edges of Upper and Lower Main Planes, the Bay is expanded to facilitate fitting the Nacelle without damaging the Struts. The Nacelle is then fitted and bolted in position.

TAIL BOOMS AND EMPENNAGE.

The Tail Booms and Empennage are all assembled away from the Machine and the whole lifted into position, and the *front ends* of the Tail Booms bolted into the Sockets on the Rear Spars of the Centre Section Planes. The Tail is supported on high trestles placed under the Lower Booms in Front of the Tail Skids.

The Tail Booms should be straight and square with the Main Cell, and all Interboom Struts should be straight and parallel to Main Cell Struts.

Check the former by measuring the distance from any point on the rear of the Tail Booms to *Bottom Sockets* on Outermost Interplane Struts. Corresponding measurements should be the same on both sides; adjust for the latter by making diagonals equal in each bay of the Booms, and check by *aligning* the Interboom Struts.

NOTE.—In adjusting the Tail Booms first make diagonals equal in middle bays of Booms and then true up by the Bracing Wires in the front and rear bays, aligning the Leading Edges of the Tail Planes with the Leading Edges of the Main Planes.

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Maurice Farman "Longhorn."—continued.

PLACING MACHINE IN FLYING POSITION.

The Machine is in Flying Position when the Engine Bearers and Top Longerons of Nacelle are level longitudinally and transversely.

It is more usual, however, to set the Machine in Flying Position with reference to the *Incidence of the Centre Section*. To place in Flying Position, support the Machine on blocks under the Undercarriage Main Skids and on a high trestle under the Tail.

Pack up the supports until the Centre Section Plane is level transversely and so that it is at an *Incidence* of 9 cms. (the height of the Front Spar above the Rear Spar).

Check by a levelled straightedge with one end under the centre of the Rear Spar and by direct measurement to the under surface of the Front Spar.

TRUING UP THE MAIN PLANES.

Place the Machine in Flying Position, i.e., so that the Centre Section is at an *Incidence* of 9 cms.

Adjust the Incidence Wires and the Rear Flying and Landing Wires until the *Incidence* at Struts L. and G. is 9.5 cms., and at Struts H. K. 10 cms., to allow for *Wash-in* on Port Side; and the *Incidence* at Struts B. and S. is 8.5 cms., and at Struts A. and T. 8 cms., to allow for *Wash-out* on Starboard Side.

EMPENNAGE.

With Machine in Flying Position the Front and Rear Spars of both Upper and Lower Tail Planes should be horizontal and parallel.

The *Incidence* of the Lower Tail Plane should be 33 mms.

Check by placing one edge of a straightedge under the centre of the Rear Spar, bring to the horizontal, and measure the height of the centre of the Front Spar vertically above the straightedge. This height should be 33 mms.

To check the setting of the Upper Tail Plane, mark points on the Rudder Posts 10 cms. *below the under surface* of the Rear Spar of Upper Tail Plane.

Straightedges from those points to the Trailing Edge of the Rear Elevator, with latter in direct continuation of the Tail Plane, should be level with Machine in Flying Position.

NOTE.—The Tail Cell should be trued up in a similar manner to the Main Cell, i.e., the Leading Edges should first be adjusted to be straight by means of the Front Bracing Wires, and the Incidence should be adjusted by the Incidence Wires and Rear Bracing Wires.

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Maurice Farman "Longhorn."—continued.

FRONT OUTRIGGERS.

These should be square with Main Cell and in line with their respective Centre Section Struts viewed from the front.

CONTROLS.

With Control Sticks Central—

1. The Front Elevator should be *horizontal* with Machine in *Flying Position.*
2. The Rear Elevator should be in direct continuation of the Upper Tail Plane.
3. The Ailerons should droop 25 mms. approximately.

With Rudder Pedals symmetrical in Nacelle, the Rudders should point directly *fore* and *aft* and be square with Machine.

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MAURICE FARMAN "LONGHORN."

BIPLANE [TYPE 1913] (80 H.P. RENAULT).

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	15m.	520mm.
Chord of " " "	2m.	013mm.
Incidence of Upper Main Planes		90mm.
Span of Lower Main Planes	11m.	516mm.
Chord of " " "	2m.	013mm.
Incidence of Lower Main Planes		90mm.
Gap	2m.	0mm.

Stagger—Line joining Leading Edges of Upper and Lower Main Planes is at right angles to full chord at Centre Section.

Dihedral		Nil.
"Wash in" at Port Outermost Struts		10mm.
"Wash out" at Starboard Outermost Struts		10mm.
Overall Length	11m.	520mm.
Height	3m.	500mm.
Span of Tail Plane	4m.	730mm.
Chord of Tail Plane	1m.	470mm.
Incidence of Lower Tail Plane		33mm.
Distance between Tail Booms	3m.	154mm.

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MAURICE FARMAN "LONGHORN."

BIPLANE [TYPE 1913] (80 H.P. RENAULT).

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Leading Edges of the Main Planes are straight in plan view.

Examine the Bracing Wires in the Main Cell and Tail Booms for length and tautness, and see that they are not bent, and are correctly secured to the Wiring Lugs.

Check the Incidence.

See that all Interplane Struts are straight and are parallel to one another.

Examine at Control Pulleys and Cables and see that they work freely, and that Turnbuckles on Cables are *locked*.

Examine Tail Cell and see that it is set correctly and is square with Machine, and that all Bracing Wires are correct both as to length and tautness, and that they are properly secured to their Wiring Lugs.

Examine Rudders and Fins and see that they are set straight and square with Machine.

Measure the Droop of the Ailerons, see that the Elevators are set correctly and that the Hinges are secure.

Examine Undercarriage and Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories.

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MAURICE FARMAN "LONGHORN" BIPLANE (TYPE 1913).

(80 H.P. RENAULT.)

RIGGING DIAGRAMS.

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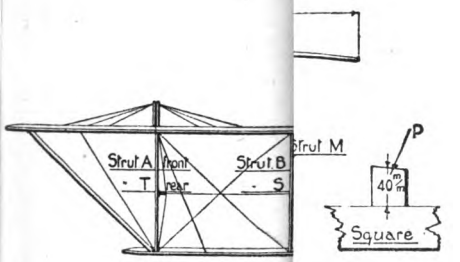

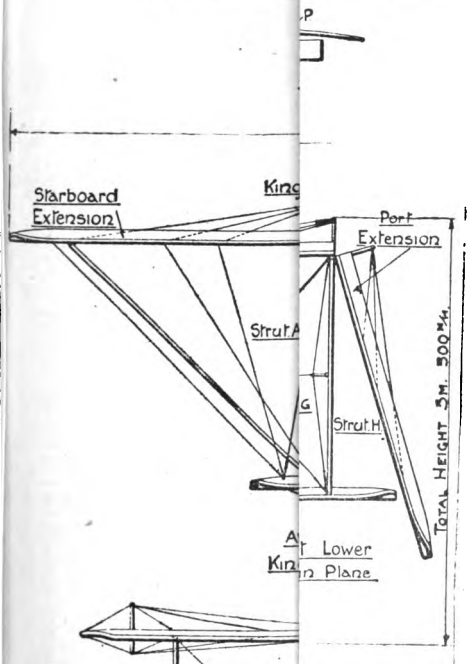

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MAURICE FARMAN "SHORTHORN" BIPLANE [TYPE 1914]. (80 H.P. RENAULT.)

RIGGING NOTES.

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MAURICE FARMAN "SHORTHORN" BIPLANE (TYPE 1914).

(80 H.P. RENAULT.)

MANUFACTURERS' ORDER OF ERECTION.

1. Main Cell assembled and Centre Section trued up and Leading Edges of Main Planes adjusted to be straight.
2. Nacelle fitted.
3. Undercarriage fitted and trued up.
4. Tail Booms and Empennage fitted and trued up.
5. Main Cell completely trued up with machine in either "Rigging Position" or "Flying Position."
6. Empennage Trued up with Machine in Flying Position.
7. Controls connected up and adjusted.
8. Engine fitted, all Tank Connections made and Engine Controls connected.

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MAURICE FARMAN "SHORTHORN" BIPLANE [TYPE 1914] (80 H.P. RENAULT.)

ERECTION AND PRELIMINARY TRUING UP MAIN CELL.

Interplane Struts are lettered as follows :—

Rear of Main Cell.

T,	S	R	P	N	M	L	K
A	B	C	D	E	F	G	H

Front of Machine.

Erect Lower Main Plane, less Ailerons, on low trestles placed *under* Sockets for Struts A, T, C, R, F, M, H, K.

Bolt up the Upper Main Plane *complete* with Ailerons and Extensions and fit Struts A, T, C, R, F, M, H, K, into their *Top Sockets*.

By means of these Struts lift the Upper Main Plane bodily into position, fitting the *bottom ends* of the Struts into their Sockets on the Lower Main Plane.

Fit all remaining Struts and loosely connect all Main Cell Wires.

Connect four temporary Diagonal Wires, two in front and two in rear at Struts D, E, N, P.

TRUING UP THE CENTRE SECTION (See Fig. 1).

True up the Centre Section until all Centre Section Struts are vertical and the line joining Leading Edges of Upper and Lower Main Planes is at right angles to the *full chord* of the Centre Section, just *outside* Struts C, R, and F, M.

Check by means of a large square.

Stretch a line from the tops of the Bottom Struts Sockets at C. and F. This line must be 5 mm. below the *tops* of the Sockets at the *bottom* of Struts D. and E.

Next, by means of the Front Interplane Bracing Wires, adjust so that the Leading Edge of the Lower Main Planes is straight in plan view, and all Front Interplane Struts are straight and parallel.

Check by stretching a line from the *tops* of Bottom Sockets at Struts A. and H. This line should cut the *tops* of Bottom Sockets at Struts B, C, F and G, and be 5 mm. below the *tops* of Bottom Sockets at Struts D. and E.

Check for Struts being straight and parallel by aligning them from the side and viewing them from the front.

FITTING THE NACELLE.

To fit the Nacelle tie ropes *over* the Nacelle supports on Struts D, E, N, P, to the *bottom* of Struts C, F, M, R, respectively, thus slightly expanding the middle Bay of the Centre Section to allow the Nacelle to be placed in position without damaging the Struts D, E, N, P.

Lift Nacelle into position and bolt up to Struts D, E, N, P, and to Cross Tubes front and rear.

The distance from Leading Edges of Rear Centre Section Struts to centre line of Rear Engine Bearer Supports measured along the *top* of the Bottom Longerons should be 25 cms.

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Maurice Farman "Shorthorn" (80 H.P. Renault).

PLACING MAIN CELL IN RIGGING POSITION.

Before fitting the Undercarriage it is necessary to get the Main Cell in Rigging Position. To do this place the Main Cell on high trestles placed under Struts A, T, and H, K.

Block up the supports until the Centre Section Struts are vertical, Check by plumb line.

TRUING UP THE UNDERCARRIAGE.

Adjust the Undercarriage Bracing Wires until the Rear Undercarriage Struts are vertical and in line with Interplane Struts R. and M. respectively, and all Undercarriage Struts on each side are in line with their Rear Strut, viewed from the front.

TAIL BOOMS AND EMPENNAGE.

The Tail Booms and Empennage are all assembled away from the Main Cell and the whole lifted into position, and the *front ends* of the Tail Booms bolted into the Sockets on the Rear Spars of the Centre Section Planes. The Tail is supported on high trestles placed under the Adjustable Steel Posts.

The Tail Booms should be straight and square with the Main Cell, and all Interboom Struts should be straight and parallel to Main Cell Struts.

Check the former by measuring the distance from any point on the rear of the Tail Booms to *bottom* Socket on Outermost Interplane Strut. This measurement should be the same on both sides; adjust for the latter by making diagonals equal in each bay of the Booms and check by *aligning* the Interboom Struts.

TRUING UP THE MAIN PLANES.

After fitting the Tail Booms and Empennage, place the Machine in Rigging Position, the supports being under the Undercarriage Main Skids and under the Adjustable Steel Posts. Adjust longitudinally by raising or lowering Tail, and transversely by packing blocks under the Undercarriage Main Skids.

Adjust the supports until the Centre Section Struts are vertical, and check for the latter by plumb lines.

In this position the Rear Spar of the Centre Section should be 40 mm. above the horizontal line, touching the Leading Edge of the Centre Section Plane. Check by a straightedge touching the Leading Edge of the Centre Section, bring to the horizontal and measure the height of the Rear Spar above this straightedge.

By means of the Incidence Wires and Rear Flying and Landing Wires adjust the Main Planes, working from the Centre Section outwards, so that this measurement is 36 mm. under Struts L. and G., and 32mm. under Struts H. and K., to allow for "*Wash In*" on the Port Side.

Under Struts B. and S. this measurement should be 44 mm., and under Struts A. and T., 48 mm., to allow for "*Wash Out*" on Starboard Side

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Maurice Farman "Shorthorn" (80 H.P. Renault).

PLACING MACHINE IN FLYING POSITION.

The Machine is in Flying Position when the Engine Bearers and Top Longerons are horizontal and level transversely.

Block the Machine up as for "Rigging Position" and check for longitudinal and transverse level by placing a spirit level over the Engine Bearers.

It is more usual in workshop practice to get the Machine in Flying Position by setting the Main Cell so that the Main Planes have the correct *Incidence*, the procedure being as follows :—

Support the Machine as in Rigging Position, but set the Main Cell so that the Centre Section is level transversely, and so that it is at an *Incidence* of 65 mm. (the height of the Front Spar above the Rear Spar). Check by a levelled straightedge with one end under the centre of the Rear Spar and by direct measurement to under-surface of Front Spar.

NOTE.

The Main Planes can be trued up with the Centre Section in Flying Position, as follows :—

Adjust the Incidence and Rear Flying and Landing Wires until the *Incidence* at Struts L. and G. is 69 mm., and at Struts H. and K. 73 mm., to allow for "*Wash In*" on the Port Side ; and the Incidence at Struts B. and S. is 61 mm., and at Struts A. and T. 57 mm., to allow for "*Wash Out*" on Starboard Side.

TAIL PLANE.

The Tail Plane can be adjusted by means of four nuts, two each side, working on threads on each Adjustable Steel Post, which passes through a fitting on the Front Spar of Tail Plane.

To set the Tail Plane correctly the Machine must be in Flying Position.

By means of the Adjusting Nuts on the Threaded Adjustable Steel Posts adjust the Tail Plane to have an *Incidence* of 43 mm. Check by placing a straightedge with one end on the *under side* of the Rear Spar, bring the straightedge to the horizontal and adjust until the height of the Front Spar, above the straightedge, is 43 mm.

NOTE.

With 70 H.P. Renault this measurement should be 40 mm.

FINS.

The Fins should be square with Machine and point directly *fore* and *aft* with Machine in Flying Position.

CONTROLS.

With the Pilot's Control Stick central the *Droop* of the Ailerons is 25 mm., and the Elevator is in continuation of the Tail Plane.

The Rudders should be vertical and point directly *fore* and *aft* with Machine in Flying Position and Rudder Control Pedals symmetrical in Nacelle.

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MAURICE FARMAN "SHORTHORN" BIPLANE [TYPE 1914].

(80 H.P. RENAULT.)

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	15m. 776mm.
Chord of „ „ „	2m. 013mm.
Angle of Incidence of Upper Main Planes	4° 20′.
Span of Lower Main Planes	11m. 764mm.
Chord of „ „ „	2m. 013mm.
Angle of Incidence of Lower Main Planes	4° 20′.
Gap	1m. 900mm.
Stagger—Line joining Leading Edges of Upper and Lower Main Planes at right angles to full chord at Centre Section.	
Dihedral	Nil.
"Wash in" at Port Outermost Struts	8mm.
"Wash out" at Starboard Outermost Struts	8mm.
Overall Length	9m. 300mm.
Height	3m. 150mm.
Span of Tail Plane	5m. 490mm.
Chord of Tail Plane	1m. 500mm.
Incidence of Tail Plane	43mm.
Diameter of Propeller	2m. 900mm.
Distance between Tail Booms	3m. 400mm.

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MAURICE FARMAN "SHORTHORN" BIPLANE [TYPE 1914]. (80 H.P. RENAULT).

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Leading Edges of the Main Planes are straight in plan view.

Examine the Bracing Wires in the Main Cell and Tail Booms for length and tautness, and see that they are not bent, and are correctly secured to the Wiring Lugs.

Check the Incidence.

See that all Interplane Struts are straight and are parallel to one another.

Examine all Controls, Control Pulleys and Cables and see that they work freely and that Turnbuckles on Cables are *locked*.

Examine Tail Plane and see that it is set correctly and is square with the Machine and that all Tail Plane Bracing Wires are correct, both as to length and tautness, and that they are properly secured to the Wiring Lugs.

Examine Rudders and Fins and see that they are set straight and square with Machine.

Measure the Droop of the Ailerons and Elevator, and see that the Hinges are secure.

Examine Undercarriage and Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories.

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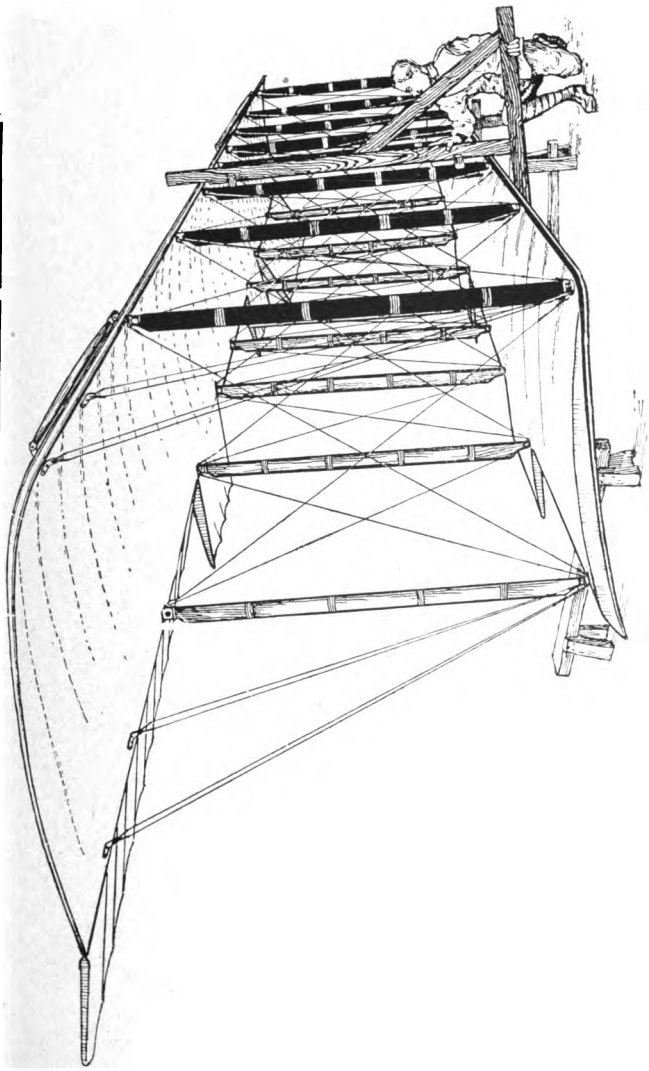

MAURICE FARMAN SHORTHORN BIPLANE (80 HP RENAULT)

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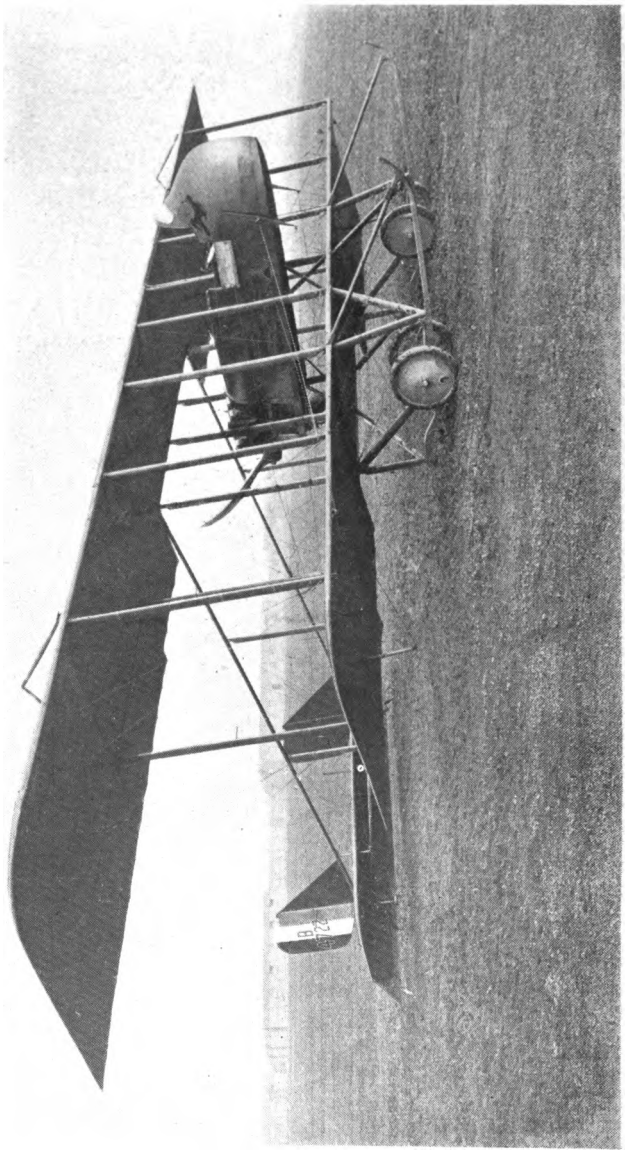
T.5. MAURICE FARMAN "SHORTHORN" BIPLANE.
[TYPE 1914.] (80 H.P. RENAULT.) FIG. 2.



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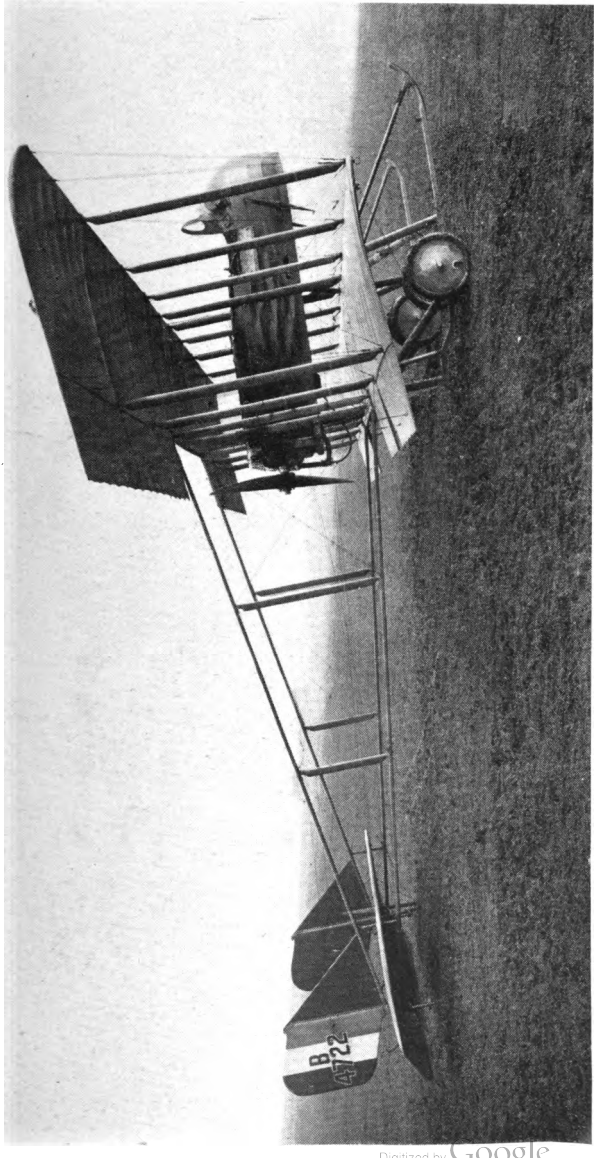
T.5. MAURICE FARMAN "SHORTHORN" BIPLANE.
[TYPE 1914.] (80 H.P. RENAULT.) FIG. 3.



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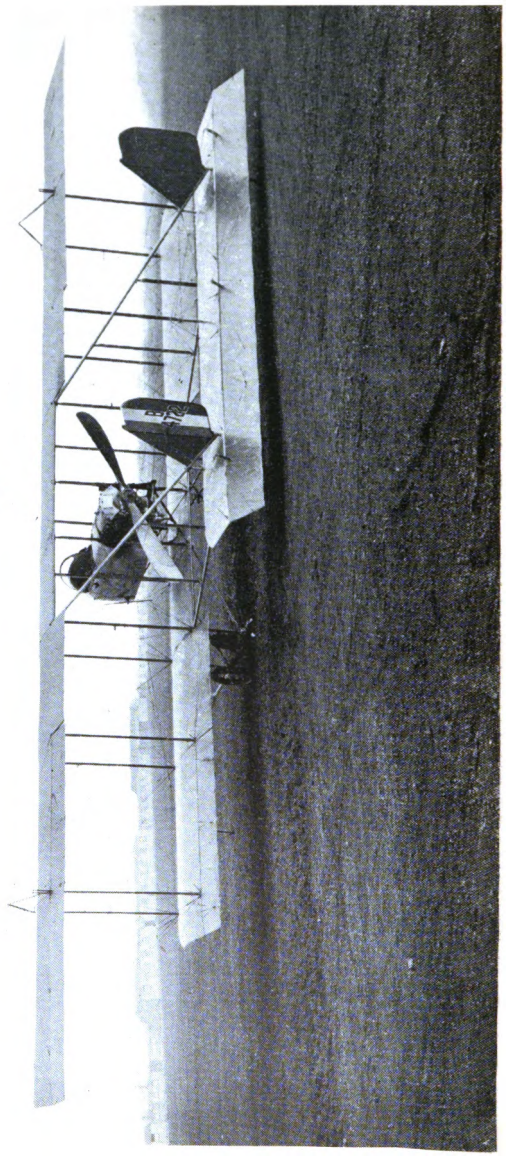
T.5. MAURICE FARMAN "SHORTHORN" BIPLANE.
[TYPE 1914.] (80 H.P. RENAULT.) FIG. 4.



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MAURICE FARMAN "SHORTHORN" BIPLANE (TYPE 1914).

(80 H.P. RENAULT.)

RIGGING DIAGRAMS.

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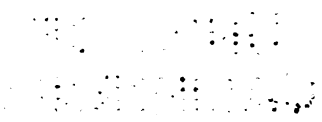

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NIEUPORT SCOUT.

130 H.P. CLERGET

RIGGING NOTES.

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MANUFACTURERS' ORDER OF ERECTION.

---

1. Fuselage assembled, less Steel Tubes and Engine Plates, and trued up.
2. Tail Skid, Steel Tubes and Engine Plates fitted and Fuselage again trued up.
3. Undercarriage fitted with Fuselage in inverted position.
4. Engine mounted.
5. Tanks fitted.
6. Gun Supports and Cartridge Case fitted.
7. Instruments fitted.
9. Centre Section Struts fitted.
10. Rudder, Tail Plane and Elevators fitted.
11. Engine Cowl fitted.
12. Fuselage covered and doped, taking care that Controls are led through correct Leads.
13. Lower Main Planes fitted.
14. Upper Main Planes fitted.
15. Rudder and Elevator Controls connected up and adjusted.
16. Aileron Controls adjusted and connected up.

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NIEUPORT SCOUT.
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RIGGING NOTES.

TRUING UP THE FUSELAGE (See Fig. 1).

With Fuselage true and in Flying Position.

(1) It is symmetrical in plan view throughout.

(2) The Top Longerons are level from No. 2 Side Struts to Tail.

(3) The Front Engine Plate and all Side Struts are vertical in side elevation.

The Side Struts are numbered from front to rear.

To true up, support the Fuselage on two trestles, one placed under the third bay and the other under the Tail.

Pack up the supports so as to level the Top Longerons as far as possible.

Working from the front.

(*a*) Adjust Internal Cross Bracing Wires making corresponding diagonals equal at each section. Check by trammel.

(*b*) Adjust Top Cross Bracing Wires making corresponding diagonals equal in each bay and check by trammel.

Check for mid points of Top Cross Struts being in one line by stretching a centre line, above the Fuselage, from the axis of the Sternpost to a lath clamped along the vertical centre line of Front Engine Plate.

Check at each mid point by means of a try square. The base of the try square should be along the Strut and the marked point to be on one edge of the blade. The top centre line should *just* touch the same edge of the blade.

(*c*) Adjust Side Bracing Wires on one side until the Top Longeron on that side is level from No. 2 Side Strut to Tail and the *front upper edge* of the Top Longeron is 50 mms. *vertically below* the forward horizontal continuation of the Top Longeron.

Proceed similarly on the other side.

(*d*) Tension Bottom Cross Bracing Wires, making corresponding diagonals equal in each bay and check by trammel.

Check for Top Longerons being level transversely by spirit level and straightedge placed transversely across the Top Longerons and check for longitudinal level by spirit level and long straightedge along the Top Longerons.

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Check for the correct setting of the Top Longerons from No. 2 Side Struts to Front Engine Plate by placing long straightedges along the Top Longerons.

The *front upper edges* of the Top Longerons should be 50mms. *vertically below* the *lower faces* of the long straightedges in contact with the Top Longerons.

Check for there being no *wind* in the Fuselage by fixing a straightedge transversely across the Top Longerons immediately in rear of No. 2 Side Struts.

Place another straightedge transversely across the Top Longerons at any other point.

The *upper edge* of the second straightedge should always be in *line* with the *upper edge* of the first straightedge. Check by sighting and repeat for other points.

A plumb line dropped from the mid point of a Top Cross Strut should strike the mid point of the corresponding Bottom Cross Strut and *just touch* the top centre line.

NOTE.—All Bolts on Fuselage are *burred* over *after* truing up.

Bolts on Engine Plates, Back Engine Bearers, and Transverse Incidence Adjusting Tube have *Spring Washers* fitted *under* the Nuts.

On all wires where Turnbuckles occur the threaded portion should be *fully engaged inside the Barrel.*

TRUING UP THE UNDERCARRIAGE (See Figs. 3 and 4)

The Undercarriage is symmetrical about the vertical centre line of the Machine and the Front Struts are vertical in Side Elevation with Machine in Flying Position.

Adjust the Front Cross Bracing Wires making corresponding diagonals equal and check by trammel.

The Undercarriage cannot be adjusted in a fore and aft direction.

NOTE.—Bolts on Undercarriage securing detachable parts are to be provided with *Split Pins*; for fixed parts they are to be *burred* over.

FIXING THE EMPENNAGE (See Figs. 4 & 5).

Before truing up the Centre Section Struts and attaching the Main Planes it is necessary to get the Machine in Flying Position, and as the Manufacturers recommend setting the Machine in Flying Position with reference to the Tail Plane the attachment and adjustment of the latter will be dealt with at this stage.

Support the Machine by blocks placed under the Undercarriage Struts and on a trestle placed under the Tail Skid.

Adjust the supports so that the Top Longerons from No. 2 Side Struts to Tail are level transversely and longitudinally.

Check for transverse level by spirit level and straightedge across the Top Longerons and make adjustments by packing blocks under the Undercarriage Struts.

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Check for longitudinal level by spirit level and long straightedge over the *upper faces* of the Top Longerons.

Make adjustments by raising or lowering Tail.

Withdraw the *Pin* on top of the Sternpost by means of the small chain inside the latter.

Fit the Rudder in position and allow the *Pin* to spring into position.

Hinge the Elevators to the Tail Plane, *not forgetting to insert the Split Pins* and place the Tail Plane with Elevators in position. Again withdraw the *Pin* on top of the Sternpost and after fitting the Tail Plane allow *Pin* to again spring back in position and insert the *Ordinary Safety Pin.*

Fit the Tail Plane Bracing Tubes and adjust the latter so that the Tail Plane is level transversely. Check by placing a spirit level on a straightedge placed transversely across the Tail Plane.

The Centre line of the Tail Plane should be horizontal.

This may be difficult to check directly, but can be checked by ensuring that the *top surface* of the Tail Plane slopes backwards and downwards at an angle of 10′ to the horizontal. This can be checked by Abney level and straightedge placed longitudinally on Tail Plane.

After adjusting, insert the *Split Pins* for the Tail Bracing Stays.

NOTE.—The *Shackles* for Control Cables are secured by Nut and *Bolt* to Kingposts, *Split Pins* being fitted.

PLACING MACHINE IN FLYING POSITION (See Fig. 4).

Machine is in Flying Position when the centre line of the Tail Plane is horizontal, the Top Longerons from No. 2 Side Struts to Tail, being level at the same time.

To place the Machine in Flying Position, support the Machine as described under Fixing the Empennage and adjust the supports until the Tail Plane is level transversely, and its *top surface* slopes backwards and downwards at 10′ to the horizontal.*

Check as described under "Fixing the Empennage."

TRUING UP THE CENTRE SECTION STRUTS (See Fig. 2).

The centre lines of the Centre Section Struts are 21 mms. from their Leading Edges.

With the Machine in Flying position the Centre Lines of the Front Centre Section Struts should be vertical viewed from the front and at an angle of 4° 10′ to the vertical when viewed from the side.

Adjust transversely by Front Centre Section Bracing Wires, making the latter equal and check by trammel.

* An alternative method would be to level off the Top Longerons.

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They cannot be adjusted in a fore and aft direction.

The centre lines of the Rear Centre Section Struts are vertical viewed from the side. These Struts cannot be adjusted, but are fixed in position by means of their Sockets.

ATTACHING THE MAIN PLANES.

Bolt the Lower Main Planes to the ends of the Incidence Adjusting Tube across the Bottom of the Fuselage, not forgetting to fit *Spring Washers* and *Split Pins*, and support the Wing Tips on trestles.

The Lower Main Planes should be set at an Incidence of 4° at the Roots. Check by Abney level and straightedge, placing the latter from Leading Edge to Trailing Edge at Ribs.

Bolt the Interplane Struts to the Upper Main Planes and fit the Ailerons, *not forgetting to insert the Split Pins.*

Lift the Upper Main Planes into position, bolt them together and to the Centre Section Struts, *not forgetting to insert the Split Pins.*

Loosely connect the Landing and Flying Wires after bolting the V Struts to the Lower Main Planes, *not forgetting to insert the Split Pins.*

NOTE.—All *Splices* on Cables are to be *Standard* 4 *Tuck.*

TRUING UP THE MAIN PLANES (See Figs. 3 and 4).

The Main Planes should be trued up in the following order :—

(*a*) Level the *top surface* of the Upper Main Planes.

Check by long straightedge transversely across the *top surface* of the Upper Main Planes. The *top edge* of this straightedge should be in line with the *top edge* of a straightedge placed transversely across the Tail Plane.

(*b*) Adjust for *Stagger.*

At the side of the Cowl the *Stagger* should be 645 mms., and at the Outer Struts the *Stagger* should be 710 mms.

Check by dropping plumb lines from the Leading Edge of the Upper Main Planes. The horizontal fore and aft distance between the Leading Edge of the Lower Main Planes and the plumb lines should be 645 mms. at the side of the Cowl and 710 mms. at the Outer Struts.

(*c*) Adjust the *Incidence* of the Lower Main Planes.

This must be 4° throughout for Starboard Lower Main Plane. Check by Abney level and straightedge, placing the latter from Leading Edge to Trailing Edge at Ribs.

For the Port Lower Main Plane the *Incidence* should be 4° *at the Root* and 5° *at the Outer Struts* to allow for Propeller Torque.

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(*d*) Check the *Dihedral Angle* for the Lower Main Planes.

This must be 2° 20′. Check by Abney level and straightedge along the Main Spar.

(*e*) The *Incidence* of the Upper Main Planes must be 1° 50′. Check by Abney level and straightedge, placing the latter from Leading Edge to Trailing Edge at *Ribs*.

Check for Leading Edges of Main Planes being square with centre line of Machine by taking measurements from Adjusting Collars at Bottom of Outer Struts to Rudderpost and Propeller Boss. Corresponding measurements should be the same on both sides.

NOTE.—After truing up the Main Planes secure the Bolts on the Outer Strut Collar Fitting by *Castle Nuts and Split Pins*, and see that the Bolts on Lower Main Plane Spar Attachments have *Spring Washers* fitted *under* the Nuts.

It is strongly recommended in cases of all *detachable parts* that *Split Pins* should be used whenever possible.

CONTROLS.

With Pilot's Control Stick central there is no *Droop* on the Ailerons and the Elevators must be in continuation of the Tail Plane.

With Rudder Bar Square in Fuselage, the Rudder should point directly *fore* and *aft* and be square with Machine.

ADJUSTING AILERON CONTROL.

Keep Pilot's Control Stick central.

Rig up Ailerons to be in continuation of Upper Main Planes.

By turning the Aileron Adjustable Connecting Rods, adjust them until they are in correct position with regard to the Aileron Kingposts.

Connect up to latter.

After final adjustments fit the 50 mm. x 6 to 5 mm. Taper Pins through Aileron Kingposts and Control Tubes, *not forgetting to fit Spring Washer and to insert the Split Pins.*

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NIEUPORT SCOUT.
130 H.P. CLERGET.

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	8 metres 160mms.
Span of Lower „ „	7 „ 800 „
Chord of Upper Main Planes	1 „ 233 „
Chord of Lower „ „	720 „
Incidence of Upper Main Planes	1° 50′
Incidence of Starboard Lower Main Plane	4°
Incidence of Port Lower Main Plane:—	
At Root	4°
At Wing Tip (to allow for Propeller Torque)	5°
Dihedral of Upper Main Planes	0°
Dihedral of Lower „ „	2° 20′
Rake of Upper Main Planes	2° 20′
Rake of Lower „ „	(approx.) 3° 30′
Angle between V Outer Struts	36° 19′
Stagger at Side of Cowl	645mms.
Stagger at V Outer Struts	710 „
Overall Length	6 metres
Height	2 „ 400 „
Angle of Incidence of Tail Plane (Top Longerons Level)	0°
Undercarriage Track	1 metre 600mms.

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NIEUPORT SCOUT.
130 H.P. CLERGET.

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Upper Main Planes are level (no Dihedral).

Check Main Planes for being square with Fuselage and Propeller Boss.

Examine the Bracing Wires in the Centre Section for length and tautness and see that all Split Pins are in position and that all Splices are sound.

Check Main Planes for Incidence and Stagger.

Examine all Main Plane Bracing Wires for length and tautness and see that all Split Pins are in position and that all Splices are sound.

Examine all Cables and Controls and see that same work freely and that Turnbuckles on Cables are locked and that all Splices are sound.

Examine Tail Plane and see :—

(a) That it is level and at zero Incidence.

(b) That it is square with Machine.

(c) That Tail Plane Bracing Stays are correct as to length and that Split Pins are in position.

(d) That Safety Pin on Top of Sternpost is in position.

Examine Rudder and see that it is set square with Machine.

See that, with Pilot's Control Stick central, there is no Droop on the Ailerons and Elevators.

Examine the Undercarriage.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls and Accessories.

Examine Gun Mounting and Gear and check for correct position with regard to the Engine ; also check Sights for alignment with Gun.

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NIEUPORT SCOUT.

(130 H.P. CLERGET.)

RIGGING DIAGRAMS.

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NIEUPORT TWO SEATER

(130 H.P. CLERGET.)

RIGGING NOTES.

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NIEUPORT TWO SEATER.

(130 H.P. CLERGET.)

MANUFACTURERS' ORDER OF ERECTION.

1. Fuselage assembled, less Steel Tubes and Engine Plates, and trued up.
2. Tail Skid, Steel Tubes and Engine Plates fitted and Fuselage again trued up.
3. Undercarriage fitted with Fuselage in inverted position.
4. Engine mounted.
5. Tanks fitted.
6. Gun Support and Cartridge Case fitted.
7. Instruments fitted.
8. Centre Section Struts fitted.
9. Rudder, Tail Plane and Elevators fitted.
10. Engine Cowl fitted.
11. Fuselage covered and doped, taking care that Controls are led through correct Leads.
12. Lower Main Planes fitted.
13. Upper Main Planes fitted.
14. Rudder and Elevator Controls connected up and adjusted.
15. Aileron Controls adjusted and connected up.

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NIEUPORT TWO SEATER.
[130 H.P. CLERGET].

TRUING UP FUSELAGE.

The Side Struts of the Fuselage are numbered from front to rear.

With Fuselage true and in Flying Position, the Top Longerons are horizontal from Side Struts No. 4 to the Sternpost.

Place the Fuselage on two trestles, one being placed under Side Struts No. 3 and the other under Side Struts No. 10.

Adjust the Internal Cross Bracing Wires until corresponding diagonals in the Transverse Sections through Side Struts Nos. 4 and 10 are respectively equal.

Mark points on Nos. 4 to 10 Side Struts 158 mm. vertically below the upper surface of the Top Longerons.

Lightly clamp a straightedge transversely across No. 4 Side Struts, and also clamp a second straightedge transversely across No. 10 Side Struts, so that the marked points coincide with the *lower edge* of the straightedge in each case.

Stretch two lines *outside* the Fuselage, one on each side, from the lower edge of the front straightedge to the lower edge of the rear straightedge.

Pack up the Fuselage until the lower edge of the front straightedge is on the same horizontal line as the lower edge of the rear straightedge. Check by spirit level and straightedge.

Lightly clamp a straightedge across the mid points of Side Struts No. 1. Stretch a line from the mid point of this straightedge to the axis of the Sternpost. This line will be *inside* the Fuselage.

Mark the mid points of all Top and Bottom Transverse Struts.

To true up proceed as follows, working from front to rear:—

(*a*) Adjust the Internal Cross Bracing Wires until corresponding diagonals are equal in each Transverse Section. (Transverse Sections 4 and 10 were trued up before the straightedges were attached.) Check by trammel.

(*b*) Adjust the Top and Bottom Cross Bracing Wires, until all the mid points on the Top and Bottom Transverse Struts and the *internal* stretched line are in the same vertical plane. Check by dropping a plumb line from the mid point of each of the Top Transverse Struts. This plumb line should just touch the *internal* stretched line, and also the mid point of the Bottom Transverse Strut in the same Transverse Section.

(*c*) Adjust the Side Bracing Wires on both sides until the marked points on all Side Struts are in line with the two *outer* stretched lines, and all Side Struts are vertical. Check the marked points by sighting them in between the two *outer* stretched lines.

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(*d*) The continuation of the two outer stretched lines should cut the Front Top Point of the Longerons. On each side of the Fuselage clamp a straightedge on Side Struts No. 4 and 5, so that its upper edge coincides with the 158 mm. marks. Now adjust the Side Cross Bracing Wires between Side Struts Nos. 2 and 4 until the point X, i.e., the Front Top Point of the Longerons, is in line with the upper edge of the straightedge.

TRUING UP THE UNDERCARRIAGE.

The Undercarriage should be symmetrical about the vertical centre line of the Machine, when viewed from the front.

Adjust the Undercarriage Cross Bracing Wires until the diagonals, between corresponding gauge points on the Front Undercarriage Struts, are equal.

The axle should be at right angles to the longitudinal axis of the Fuselage. Check by taking measurements from the lower socket of the Sternpost to the Axle End Collar of the Undercarriage Wheels. These measurements should be the same on both sides.

PLACING MACHINE IN RIGGING POSITION.

Before truing up the Centre Section and attaching the Main Planes, it is necessary to place the Machine in Rigging position.

To do this, block up the Machine under the Undercarriage Struts, and support the Tail on a trestle placed near the Sternpost.

The Machine is in Rigging Position when the Top Longerons, between Side Struts No. 4 and the Sternpost, are level transversely and longitudinally.

Level transversely by spirit level and straightedge placed across the Top Longerons, and make any adjustments by packing blocks under the Undercarriage Struts.

Level longitudinally by spirit level placed on the Top Longerons, and make adjustments by raising or lowering the Tail.

TRUING UP CENTRE SECTION.

The Centre Section should be symmetrical about the vertical centre line of the Machine, when viewed from the front.

Adjust transversely by Centre Section Front Cross Bracing Wires, until corresponding diagonals are equal. Check by trammel.

The Centre Section cannot be adjusted longitudinally, as it is fixed in position by the Diagonal Side Struts.

The Incidence of the Centre Section Plane should be 3½°. If this be found incorrect, check the truing up of Fuselage.

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The Centre Section Struts are all vertical when viewed from the front, and the Rear Centre Section Struts are also vertical when viewed from the side.

ATTACHING THE MAIN PLANES.

Bolt the Lower Main Planes to the ends of the Incidence Adjusting Tube across the bottom of the Fuselage (not forgetting to fit *Spring Washers* and *Split Pins*), and support the Planes by trestles placed under the Interplane Struts.

Bolt the Interplane Struts to the Upper Main Planes, fit the Ailerons, and lock all nuts with Split Pins.

Lift the Upper Main Planes into position, connect them to the Centre Section, and bolt the Interplane "V" Struts to the Lower Main Planes. Lock the nuts with Split Pins.

Loosely connect the Landing and Flying Wires.

TRUING UP MAIN PLANES.

The *angle of set back* of both Upper and Lower Main Planes is 2° 45′. The Port and Starboard Main Planes should be symmetrical in plan about the longitudinal centre line of the Fuselage.

Check by taking measurements from Bottom Sockets of Outer Interplane Struts to Rudderpost and Propeller Boss. Corresponding measurements should be the same on both sides.

There is no *Dihedral* on the Upper Main Planes. Check the level of these by spirit level and straightedge placed along the Front Spar. The *top edge* of this straightedge should be in line with the *top edge* of a straightedge placed transversely across the Tail Plane.

The Dihedral for the Lower Main Planes is approximately 2°. Adjust by Front Landing Wires, and check by Field Clinometer, or Abney level and straightedge, placed along the Main Spar. (There is only one spar in the Lower Main Planes.)

The *Stagger* of the Main Planes should be 2′ 10½″ at the Root, and 2′ 10⅞″ at the Cellule. Slight adjustments may be made by the Landing and Flying Wires. Check by dropping lines from the Leading Edges of the Upper Main Planes. The horizontal *fore* and *aft* distance between these plumb lines and the Leading Edges of the Lower Main Planes should be 2′ 10½″ at the Root of the Planes, and 2′ 10⅞″ at the Cellule.

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The *Incidence* of the Upper Main Planes is $3\frac{1}{2}°$ throughout. Check by Field Clinometer, or Abney Level, and straightedge, placing the latter along the Chord of a Rib, (1) at the Rib nearest the Root of the Plane, and (2) at the Rib nearest the Wing Tip. To alter the Incidence near the Wing Tip, adjust the Rear Bracing of the Cellule.

The Incidence of the Starboard Lower Main Planes is 4° throughout. The Incidence of the Port Lower Main Plane should be 4° *at the Root* and 5° at the *Wing Tip,* to allow for Propeller Torque.

To alter the Incidence of the Lower Main Planes, turn the Plane round its single Spar, after unscrewing the collars of the Strut Sockets, and the collars of the Cross Tube in the Fuselage at the Roots of the Planes.

FIXING THE TAIL UNIT.

Bolt the Tail Plane in position, adjusting the Tail Plane Bracing Tubes until it is level transversely. Check by a spirit level on a straightedge, placed transversely across the Tail Plane.

The Rear Tube of the Tail Plane should be square with the longitudinal axis of the Machine. Check by taking measurements from Bottom Sockets of Rear Outer Struts to lateral extremities of Rear Tube of Tail Plane. Corresponding measurements should be the same on both sides.

The Centre Line of the Tail Plane should be horizontal.

Hinge the Elevators to the Tail Plane Rear Tube, and attach the Fin and Rudder, taking care to insert all split pins. The Fin should point directly *fore* and *aft,* and be square with the Machine.

CONTROLS.

With Pilot's Control Stick in vertical position there is no *Droop* on the Ailerons, and the Elevators must be in continuation with the Tail Plane.

With Rudder Bar square in Fuselage, the Rudder should point directly *fore* and *aft,* and be square with Machine.

LONGITUDINAL BALANCE OF MACHINE.

When the Machine is *nose heavy* the Incidence of the Lower Main Plane must be *reduced.*

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When the Machine is *tail heavy* the *Incidence* of the lower Main Plane must be *increased.*

Should the balance require too great a reduction of Lower Main Plane Incidence, it is permissible to increase the Incidence at the Wing Tips of the Upper Main Planes.

Under no circumstances must the setting of the Fixed Tail Plane be altered.

NOTE.—After truing up the Main Planes, secure the Bolts on the Outer Strut Collar Fittings by *Castle Nuts and Split Pins,* and see that the Bolts on Lower Main Plane Spar Attachments have *Spring Washers* fitted under the nuts.

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NIEUPORT TWO SEATER.

(130 H.P. CLERGET.)

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	29′ 7½″
Span of Lower Main Planes	26′ 0″
Chord of Upper Main Planes	6′ 0″
Chord of Lower Main Planes	6′ 0″
Incidence of Upper Main Planes	3½°
Incidence of Starboard Lower Main Plane	4°
Incidence of Port Lower Main Plane—	
At Root	4°
At Wing Tip (to allow for Propeller Torque)	5°
Stagger—	
At Root of Planes	2′ 10½″
At Cellule	2′ 10⅞″
Dihedral Upper Main Planes	Nil.
Dihedral Lower Main Planes	2°
Angle of Set Back of Main Planes	2° 45′
Overall Length	23′ 11¼″
Height	8′ 10″
Incidence of Tail Plane (Centre Line)	Nil.
Droop of Ailerons (with Pilot's Control stick in vertical position)	Nil.
Droop of Elevators (with Pilot's Control Stick in vertical position)	Nil.

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NIEUPORT TWO SEATER.

(130 H.P. CLERGET.)

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Upper Main Planes are level (no Dihedral).

Check Main Planes for angle of set back.

Examine the Bracing Wires in the Centre Section for length and tautness, and see that all Split Pins are in position, and that all Splices are sound.

Check Main Planes for Incidence and Stagger.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position, and that all Splices are sound.

Examine all Cables and Controls, and see that the same work freely, and that Turnbuckles on Cables are locked, and that all Splices are sound.

Examine Tail Plane, and see:—

(*a*) That it is level and at zero Incidence.
(*b*) That it is square with Machine.
(*c*) That Tail Plane Bracing Stays are correct as to length, and that Split Pins are in position.
(*d*) That Safety Pin on Top of Sternpost is in position.

Examine Rudder, and see that it points directly fore and aft when Rudder Bar is square across Fuselage.

See that, with Pilot's Control Stick vertical, there is no *Droop* on the Ailerons and Elevators.

Examine the Undercarriage.

Examine Tank Mountings and Connections.

Examine Engine Mountings, Engine Controls, and Accessories.

Examine Gun Mounting and Gear, and check for correct position with regard to the Engine; also check Sights for alignment with Gun.

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NIEUPORT TWO-SEATER (130 H.P. CLERGET.)

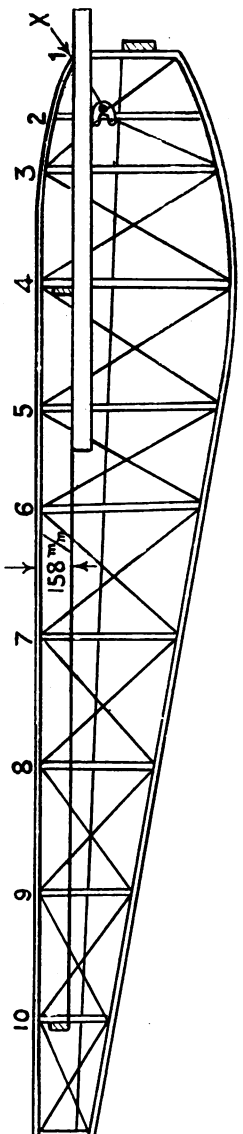

FIG. 1.
TRUING UP FUSELAGE.

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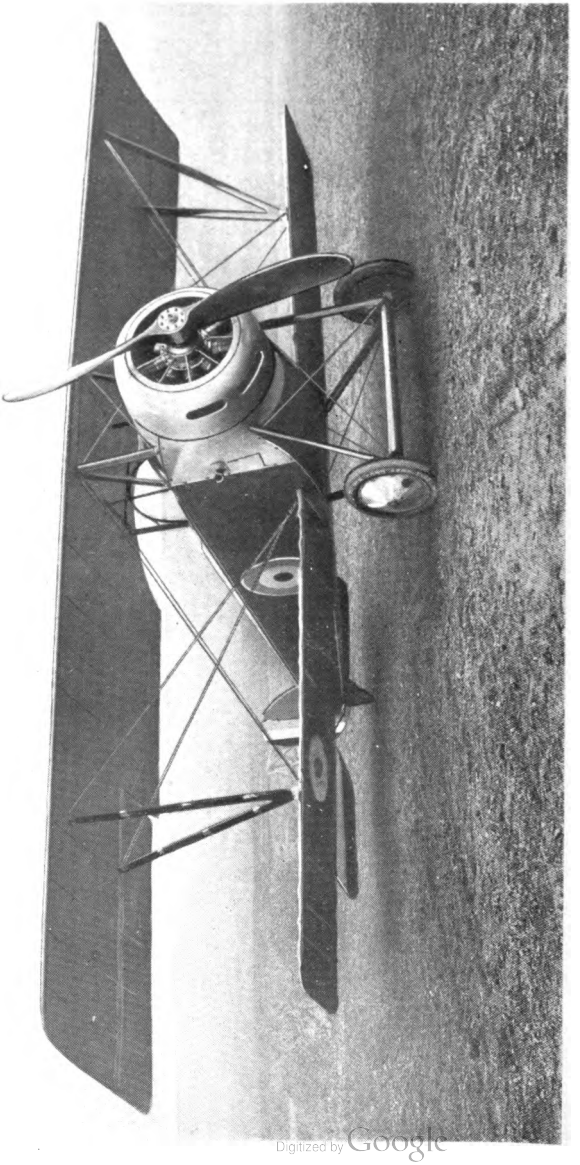
NIEUPORT TWO-SEATER (130 H.P. CLERGET.) FIG. 2.



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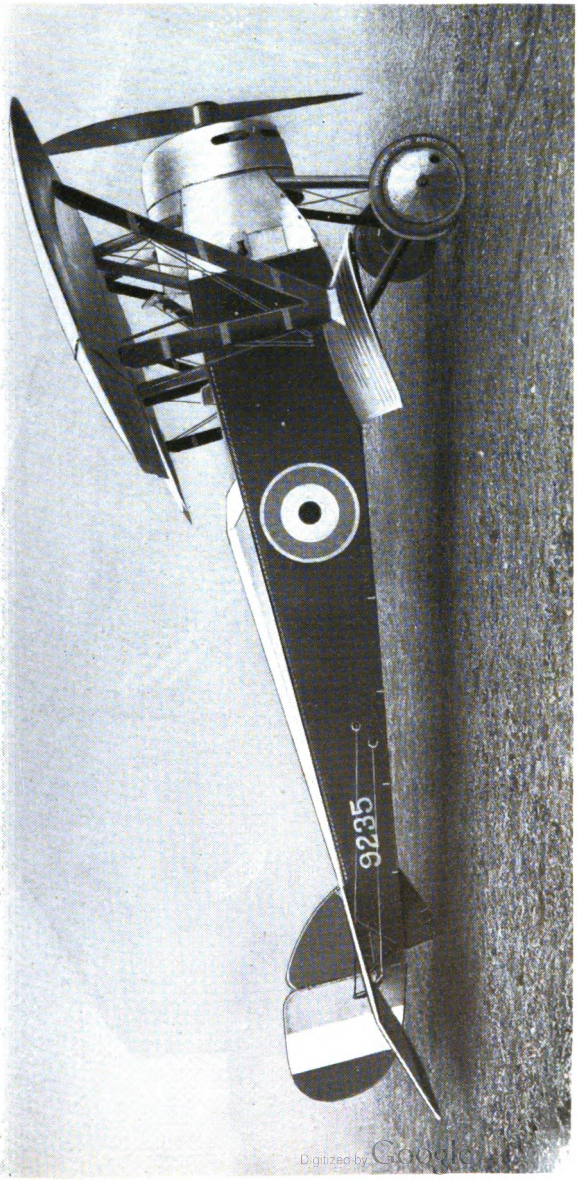
NIEUPORT TWO-SEATER (130 H.P. CLERGET.) FIG. 3.



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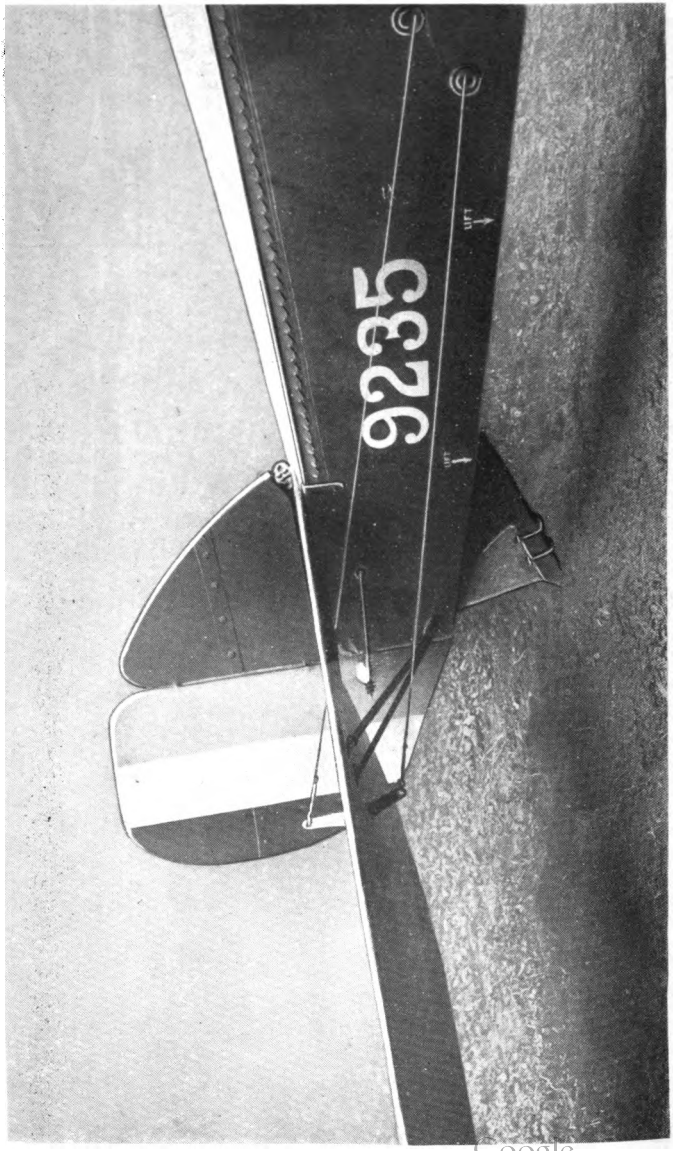
NIEUPORT TWO-SEATER (130 H.P. CLERGET.) FIG. 4.



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NIEUPORT TWO-SEATER.

(130 H.P. CLERGET.)

RIGGING DIAGRAMS.

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R.E.7.

(150 H.P. R.A.F.4A.)

(160 H.P. BEARDMORE.)

(250 H.P. ROLLS-ROYCE.)

RIGGING NOTES.

THE ILLUSTRATIONS REFERRED TO IN THE TEXT ARE IN COURSE OF PREPARATION.

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(150 H.P. R.A.F.4A.)
(160 H.P. BEARDMORE.)
(250 H.P. ROLLS-ROYCE.)

MANUFACTURERS' ORDER OF ERECTION.

1. Fuselage assembled and trued up.
2. Undercarriage fitted to Fuselage.
3. Controls fitted in front of Fuselage.
4. Tail Skid fitted.
5. Main Petrol and Oil Tanks fitted.
6. Engine mounted.
7. Engine Controls fitted.
8. Instrument Board fitted.
9. Front Cowling fitted.
10. Centre Section fitted and trued up with Machine in Rigging Position.
11. Empennage fitted.
12. Fairing fitted.
13. Elevator and Rudder Controls fitted and adjusted.
14. Fuselage covered and doped.
15. Main Planes attached and trued up.
16. Controls connected and adjusted.

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(150 H.P. R.A.F.4A.)

(160 H.P. BEARDMORE.)

(250 H.P. ROLLS-ROYCE.)

TRUING UP THE FUSELAGE.

The Side Struts are numbered from front to rear.

With Fuselage true and in Rigging Position, the Top Longerons are horizontal from Side Struts No. 1 to Side Struts No. 5.

Place the Fuselage on two trestles, one being placed under Side Struts No. 2 and the other under Side Struts No. 10.

Trammel and adjust the Internal Cross Bracing Wires in the transverse sections through Side Struts Nos. 1 and 10 until the diagonals are respectively equal.

Mark points $12\frac{5}{16}$" below the upper surface of the Top Longerons on all Side Struts from Nos. 1 to 5 inclusive, and mark the mid points of all Side Struts to the rear of Side Struts No. 5.

Lightly clamp straightedges transversely across Side Struts Nos. 1 and 10, so that the marked points coincide with the upper edge of the straightedge in each case.

Stretch two lines *outside* the Fuselage, one on each side, from the upper edge of the front straightedge to the upper edge of the rear straightedge.

Stretch a line from the mid point of the front straightedge to the axis of the Sternpost. This line will be inside the Fuselage.

Mark the mid points of all Top and Bottom Struts.

Working from front to rear, adjust the Internal Cross Bracing Wires until corresponding diagonals are equal at each Transverse Section. (Transverse Sections 1 and 10 were trued up before the straightedges were attached.) Check by trammel.

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R.E.7—Continued.

Adjust the Top and Bottom Cross Bracing Wires until all the mid points on the Top and Bottom Transverse Struts and the *internal* stretched line are in the same vertical plane. Check by dropping a plumb line from the mid point of each of the Top Transverse Struts. This plumb line should just touch the *internal* stretched line, and also the mid point of the Bottom Transverse Strut in the same Transverse Sections.

Adjust the Side Cross Bracing Wires on both sides until the marked points on all Side Struts are in line with the two outer stretched lines, and all Side Struts are vertical. Check the marked points by sighting them in between the *outer* stretched lines.

TRUING UP THE UNDERCARRIAGE.

The Undercarriage should be symmetrical about the vertical centre line of the Machine when viewed from the front. Adjust the Undercarriage Cross Bracing Wires until corresponding diagonals are equal. Check by dropping plumb lines from the mid points of the Bottom Transverse Struts which are above the Undercarriage. These plumb lines should bisect the Centre Longitudinal Tube of the Undercarriage Frame.

The axle should be at right angles to the longitudinal axis of the Fuselage. Check by taking measurements from the Rudderpost to the Axle End Collar of the Undercarriage Wheels. Corresponding measurements should be the same on both sides.

The centre line of the Axle should be 7½" in front of the axis of the first Transverse Steel Tube at the bottom of the Fuselage. Check by dropping a plumb line from the first Transverse Steel Tube. The fore and aft distance of the centre line of the Axle from the plumb line should be 7½".

PLACING THE MACHINE IN FLYING POSITION.

Before truing up the Centre Section and attaching the Main Planes it is necessary to get the Machine in Flying Position.

To do this, block up the Machine under the Undercarriage Struts and support the Tail on a trestle placed near the Sternpost.

The Machine is in Flying Position when the Top Longerons between Side Struts Nos. 1 and 5 are level transversely and longitudinally.

Level transversely by spirit level and straightedge placed across the Top Longerons, and make any adjustments by packing blocks under the Undercarriage Struts.

Level longitudinally by spirit level placed on the Top Longerons, and make any adjustments by raising or lowering the Tail.

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R.E.7—Continued.

TRUING UP THE CENTRE SECTION.

In this Machine there is no Centre Section Upper Plane. The Centre Section consists of a Rib, inclined at the angle of Incidence, to which the Port and Starboard Upper Main Planes are attached.

This Centre Rib is supported by Pylons, the lower extremities of which are attached to the Top Longerons at Side Struts Nos. 1 and 3. The Pylons should be symmetrical about the vertical centre line of the Machine when viewed from the Front.

The Incidence and Stagger of the Centre Rib is adjusted by means of the four Drift and Anti-Drift Cables attached to the apices of the Pylons.

ATTACHING THE MAIN PLANES.

The Main Planes are assembled with their Leading Edges on the ground. All Interplane Struts are fitted and the Incidence and Outer Flying and Landing Wires are loosely connected.

The Planes are then lifted into position, and the ends of the Spars of the Lower Main Planes are inserted in the Front and Rear Spar Brackets. The ends of the Spars of the Upper Main Planes are inserted in the Front and Rear Spar Attachments on the Centre Section Rib.

The Inner Landing and Flying Wires are now loosely connected.

TRUING UP MAIN PLANES.

Adjust the Front Landing Wires until the distances XX and YY are respectively equal on the Port and Starboard sides. The distance XX is the distance between a point on the apex of the Front Pylon and the Bottom Socket of the Front Outer Strut. The distance YY is the distance between a point on the Front Spar at the Root of the Lower Main Plane and the Top Socket of the Front Outer Interplane Strut.

The Leading Edges of both Upper and Lower Main Planes should be symmetrical in plan about the longitudinal centre line of Machine. Check by taking measurements from Bottom Sockets of Front Outer Struts to Rudderpost and Drag Wiring Plates. Corresponding measurements should be the same on both sides.

The *Dihedral* is 2½° for both Upper and Lower Main Planes. Adjust by Front Landing Wires and check by Field Clinometer or Abney level and straightedge, placing the latter along the Front Spars. A taut cord stretched across the Upper Main Planes between points over the Front Outer Struts should be 7″ above the Front Spar of the Centre Section. Check by taking measurements at the lateral extremities of the Centre Section Upper Main Plane.

The *Stagger* of the Main Planes is 2.9″ throughout. Adjust by Incidence Wires and check by dropping plumb lines from the Leading Edges of the Upper Main Planes, one plumb line being

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R.E.7—Continued.

in front of each strut. The horizontal fore and aft distance between these plumb lines and the leading edges of the Lower Main Planes should be 2.9″.

NOTE.—With the 250 H.P. Rolls-Royce the Stagger is 11″.

The *Incidence* of the Port Main Planes is 4° throughout. The Incidence of the Starboard Main Planes is 4° at the *Root* and 3½° at the *Outer Struts*, to allow for Propeller Torque. Adjust by Incidence Wires, Rear Landing and Flying Wires, and check by Field Clinometer or Abney level and straightedge, placing the latter along the chord of a Rib, (1) at the Rib nearest the Root of the Plane and (2) at the Rib to which the Outer Struts are attached.

NOTE.—With the 250 H.P. Rolls-Royce the Incidence is 30.6″, with ½° Wash-out in Starboard Main Planes.

After the Main Planes have been trued up, the Auxiliary Flying Wires should be adjusted. Great care must be taken not to adjust these wires so tight as to cause initial stresses in the Upper Main Plane Spars.

FIXING THE EMPENNAGE.

Fit and bolt the Fin in position. It should point directly fore and aft and be square with the Machine.

The Tail Plane is supported on each side by two steel Bracing Tubes, which pass from the Fin to the Front and Rear Spars, and also by a Bracing Wire which passes from the Fin to the Front Spar. True up until the Tail Plane is level transversely and is square with Machine. Check for transverse level by spirit level placed along the Spars, and check for symmetry by taking measurements from the Bottom Sockets of Rear Outer Struts to the lateral extremities of the Tail Plane Rear Spar. Corresponding measurements should be the same on both sides.

The Angle of Incidence of the centre line of the Tail Plane is 4°.

Hinge the Rudder to the Rudderpost, inserting the Hinge Pins and Split Pins. The Rudder should be vertical. Check by plumb line.

Hinge the Elevators to the Tail Plane, inserting the Split Pins, and connect up all Control Wires.

CONTROLS.

Adjust the Controls so that:—

(*a*) With Pilot's Control Stick in vertical position, the Ailerons should droop 1″.

(*b*) With Pilot's Control Stick in vertical position, the Elevators should be in continuation with the Tail Plane.

(*c*) With the Rudder Bar square in the Fuselage, the Rudder and Tail Skid should point directly fore and aft and be square with the Machine.

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R.E.7.

(150 H.P. R.A.F.4A.)

(160 H.P. BEARDMORE.)

(250 H.P. ROLLS-ROYCE.)

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Main Planes are symmetrical about the centre line of Machine.

See that all Lock Nuts for Bracing Wires are tight.

Examine the Bracing Wires for length and tautness in the centre section, and see that all Split Pins are in position.

Check the Dihedral.

Check the Incidence.

See that the Interplane Struts are straight, undamaged and streamlined in the direction of flight.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position.

Examine all Controls, Pulleys and Cables and see that they work freely, and that all Turnbuckles on Cables are locked.

Examine the Tail Plane and see that it is set correctly and is square with Machine, and that all Tail Plane Bracing Wires are correct both as to length and tautness, and that all Split Pins are in position.

Examine Rudder and Fin and see that these are set straight and square with Machine.

Measure the droop of the Ailerons.

Examine Undercarriage and Tail Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories.

NOTE.—After a machine has been erected or overhauled and found to be trued up correctly, it is advisable to measure the Pin Centre Lengths of all Landing Wires. These lengths can then be used in any subsequent erection, and the Machine quickly trued up to the required conditions.

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R.E.7.

(150 H.P. R.A.F.4A.)

(160 H.P. BEARDMORE.)

(250 H.P. ROLLS-ROYCE.)

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	57′ 0″
Span of Lower Main Planes	42′ 0″
Chord of Upper Main Planes	6′ 0″
Chord of Lower Main Planes	6′ 0″
Incidence of Port Main Planes	4° throughout.
Incidence of Starboard Main Planes	4° at Root. 3½° at Outer Struts.
Stagger (with 150 H.P. R.A.F.4a and 160 H.P. Beardmore)	2.9″
Stagger (with 250 H.P. Rolls-Royce) (With 250 H.P. Rolls-Royce the Incidence is 3° 6′, with ½° Wash-out in Starboard Main Planes.)	11″
Dihedral—Upper Main Planes	2½°
Dihedral—Lower Main Planes	2½°
Overall Length	31′ 10½″
Height	12′ 7″
Incidence of Tail Plane (Centre Line)	4°
Droop of Ailerons (with Pilot's Control Stick in vertical position)	1″
Droop of Elevators (with Pilot's Control Stick in vertical position)	Nil.

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R. E. 8.

(150 H.P. R.A.F. 4A.)

RIGGING NOTES.

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R. E. 8.

(150 H.P. R.A.F. 4.A.)

MANUFACTURERS' ORDER OF ERECTION

1. Front Portion of Fuselage assembled and trued up.
2. Rear Portion of Fuselage assembled and trued up.
3. Front and Rear Portions of Fuselage joined and lined up, with Fins fitted in Skeleton.
4. Undercarriage fitted.
5. Pilot's Wind Shield (Baffle Plate) fitted.
6. Engine mounted.
7. Controls fitted in front of Fuselage.
8. Hand Wheel for Tail Plane Actuating Gear and Support Cables for Pilot's Control Stick fitted.
9. Fairing, with Instrument Board, fitted.
10. Instruments, Flexible Drive for Revolution Indicator, Pitôt Tubing, Oil Gauge Pipes, Ignition Wires and all Fittings immediately in front of Dashboard fitted.
11. Gun Mount and remaining Fuselage Accessories fitted.
12. Main Petrol Tank and Oil Tank fitted.
13. Upper and Lower Centre Section Planes fitted with Machine in Flying Position.
14. Front Petrol Tank fitted.
15. Oil, Petrol and Air Service connected up.
16. Tail Plane Actuating Gear fitted.
17. Empennage fitted and Controls to latter adjusted.
18. Empennage dismantled less Fins.
19. Fuselage and Fins covered and doped.
20. Empennage refitted.
21. Main Planes attached.
22. Controls connected up and adjusted.
23. Engine Cowl fitted.

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R. E. 8.

(150 H.P. R.A.F. 4.A.)

TRUING UP THE FUSELAGE.

Support the Fuselage so that the Spar Tubes at the bottom of the Fuselage are level transversely, and Side Struts 1, 2, 3, and 4, are vertical, as far as possible.

Adjust the Side Bracing Wires in the first three bays until the Spar Tubes are level transversely.

Mark the mid points of all Cross Struts top and bottom, and mark the mid points of all Side Struts in the Rear Portion.

Stretch a *centre line above* the Fuselage from the mid point of the Front Top Cross Strut to the *axis* of the Finpost, and stretch another *centre line* from the mid point of the Cross Strut in front of the Engine Bearers to the *axis* of the Finpost. This second line will be *inside* the Fuselage.

Drop four plumb lines, one along the *centre line* of each Side Strut at the Spar Tubes, and drop another plumb line along the Finpost. Before any truing up is attempted it is necessary to ensure that Strut Sockets are accurately spaced along the Longerons, and particularly that corresponding consecutive Sockets on both sides are equally spaced; also that all Struts are cut accurately to length.

Work from front to rear, and—

(a) Adjust Internal Cross Bracing Wires, making corresponding diagonals equal at each section, and check by trammel all through.

(b) Adjust Top Cross Bracing Wires until mid points of all Top Cross Struts are in line with *top stretched centre line*. Check by try square at each mid point. The base of the square should be along the Strut, and the mid point should be on one edge of the blade. The *top stretched centre line* should *just touch* the same edge of the blade.

(c) Adjust Bottom Cross Bracing Wires so that a plumb line dropped from any point on the side of the Top Longerons *just touches* the corresponding side of the Bottom Longerons.

Check for bottom of Fuselage being *symmetrical* about longitudinal centre line of Machine by taking measurements from the *axis* of the Finpost and Tail Spar Eye Bolts to the lateral extremities of the Rear Spar Tube. Corresponding measurements should be the same on both sides.

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(d) Adjust the Side Bracing Wires on one side until the *first four* Side Struts are *vertical* and the mid points of the Struts of the Rear Portion are in line; this line to slope *upwards towards the rear at* 5¼° to the horizontal. Check for the first four Struts being vertical by the plumb lines, and check for the correct alignment of the mid points of the Side Struts on the Rear Portion by Abney level and long straightedge, truing up from marked point to marked point, and moving the straightedge from front to rear. Proceed similarly for the other side.

The Finpost should be continually checked for being vertical. Check for there being no twist in the Fuselage as follows:— Fix a straightedge transversely across the Top Longerons above the Front Spar Tube, about 2½" from Strut Sockets. Place another straight edge transversely across the Top Longerons at any other point, about 2½" from Strut Sockets. The upper edge of the movable straight edge should always be in line with the upper edge of the fixed straightedge. Work from front to rear, and check for a series of points along the Top Longerons.

The Engine Bearers should be symmetrical about the longitudinal centre line of Machine, and the *top faces* of the Bearer Fittings should be in line and slope upwards towards the front at 4° to the horizontal.

Check by Abney level and long straightedge over the faces of the Engine Bearer Fittings.

A plumb line dropped from or to the mid point of a Cross Strut should *just touch* the internally stretched centre line.

NOTE.

(a) It is important in truing up the Fuselage not to overtighten the Tie Rods, and so prevent unnecessary compressive stresses on the Struts and Longerons.

(b) Care should be taken with the Lock Nuts on the Tie Rods. Overtightening may fracture the Rod, or the Rod may give under the load, and it is therefore important to notice whether the thread is right-handed or left-handed when unlocking a Nut.

(c) All Bolts on the Fuselage, with the exception of the four B.A. Bolts, which should be *burred over*, should be *Split Pinned after truing up the Fuselage.*

CARE OF FUSELAGE.

The Fabric Side Covering should be taken down occasionally, and a thorough inspection made of all Fuselage Members and Fittings.

Excessive stresses, such as those caused by a bad landing, may cause Bolts and Wiring Plates to pull into the material of the Members. In such cases Bolts and Tie Rods will require adjustments. If the damage to the material has been excessive, the Members may require to be replaced, but in all ordinary cases it will only be necessary to readjust the Tie Rods so that they are just tight.

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TRUING UP THE UNDERCARRIAGE.

Adjust the Front Cross Bracing Wires, making corresponding diagonals equal, and check by trammel.

PLACING THE MACHINE IN FLYING POSITION.

Before truing up the Upper Centre Section and attaching and truing up the Main Planes, it is necessary to get the Machine in Flying Position.

The Machine is in Flying Position when the *top faces* of the Bottom Longerons *between the Spar Tubes* are level longitudinally and the Spar Tubes themselves level transversely.

To get the Machine in Flying Position, support it on blocks placed under the Undercarriage Struts and on a trestle placed under the Tail.

Level longitudinally off the top faces of the Bottom Longerons between the Spar Tubes, and make adjustments by raising or lowering the tail.

Level transversely off the Rear Spar Tube, and make adjustments by packing blocks under the Undercarriage Struts.

NOTE.—Do not place any supports under the Webbing of the Front Bottom Longerons.

FITTING THE UPPER CENTRE SECTION.

Before fitting the Upper Centre Section Plane, place it upside down on trestles, and fix and split pin all Centre Section Bracing Wires.

Bolt the Struts to the Upper Centre Section Plane, lift into position on Machine, and bolt the lower ends of the Struts to the fittings on the Top Longerons.

Loosely connect up the Bracing Wires.

The Main Plane Landing Wires are also attached to the Lugs on the Upper Centre Section Plane.

Fit the Lower Centre Section Planes in position.

TRUING UP THE CENTRE SECTION.

Before truing up the Centre Section see that the Machine is in Flying Position.

The Upper Centre Section Plane should be trued up whenever possible *before* the Front Petrol Tank is fitted, otherwise it will be difficult to trammel the Front Cross Bracing Wires.

The Upper Centre Section Plane should be symmetrical about the vertical centre line of Machine. Adjust by Front Cross Bracing Wires, making corresponding diagonals equal, and check by trammel.

The Stagger of the Upper Centre Section Plane should be 24". Adjust by Side Cross Bracing Wires, and check by measuring the horizontal fore and aft distance between the Leading Edges of the Lower Centre Section Planes and plumb lines dropped from the Leading Edge of the Upper Centre Section Plane. These measurements should be 24".

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After truing up the Centre Section connect up the Front Drag Wires.

NOTE.—The Cross Bracing Wires of the Centre Section form a very important part of the Wing Bracing in this Machine.

Particular attention should be given to the adjustment of these, and also to the condition of the Supporting Bolts and Wiring Plates.

ATTACHING THE MAIN PLANES.

The Lower Main Planes, with the Hinge Jaws bolted in position, are pinned to the Spar Tubes, and the Landing Wires loosely connected. The Upper Main Planes are then lifted and bolted in position, the Interplane Struts fitted into their Sockets on the Lower Main Planes, and the Flying, Deflection and Incidence Wires loosely connected.

TRUING UP THE MAIN PLANES.

DIHEDRAL. The Dihedral is 3½° for both Upper and Lower Main Planes. Adjust by Front Landing Wires, and check by Abney level and straightedge along the Front Spars. As an alternative or additional method proceed as follows:—

Stretch a line across the Upper Main Planes from *centre to centre of tops* of Front Outer Struts.

Adjust the Front Landing Wires until this line is 6.1″ vertically above the top of the Front Spar of the Upper Centre Section Plane. Check at lateral extremities of latter.

STAGGER. The Stagger should be 24″ throughout. Adjust by the Incidence Wires, and check by measuring the horizontal *fore and aft* distance between the Leading Edges of the Lower Main Planes and plumb lines dropped from the Leading Edges of the Upper Main Planes. These measurements should be 24″.

INCIDENCE. The Incidence should be 4° throughout for both Upper and Lower Main Planes. Adjust by Incidence Wires and Rear Landing and Flying Wires, and check by Abney level and straightedge, placing the latter from Leading edge to Trailing edge at Ribs.

Check for Main Planes being square with Machine by taking measurements from Top and Bottom Sockets of Front Outer Struts to axis of Finpost and to centre of Propeller Boss. Corresponding measurements should be the same on both sides.

FIXING THE EMPENNAGE.

Bolt up the two portions of the Tail Plane and insert the Split Pins.

Loosely connect up the Tail Plane Bracing Wires.

Hinge the Rudder in position and insert the Split Pins.

Similarly hinge the Tail Skid in position.

Hinge the Elevators in position and insert the Split Pins.

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The Tail Plane should be adjusted so that it is level transversely and square with Machine. Check the former by spirit level over the Spars, and the latter by taking measurements from Bottom Sockets of Rear Outer Struts to lateral extremities of Rear Spar of Tail Plane. Corresponding measurements should be the same on both sides.

The Fins should point directly fore and aft, and be square with Machine.

TAIL PLANE ACTUATING GEAR.

With the hole in the Hand Wheel vertically over the centre of the axis of the Wheel, the Bolt on the Sliding Tube engaging in the slot of the Finpost should be in its mean position, and there should be an equal length of chain on either side.

When this is the case, the *Incidence* of the Tail Plane should be 1½°.

NOTE.—The tension of the Wires supporting the Tail Plane should be sufficient to hold the Tail Plane rigidly to the Fuselage without placing undue stresses on the Spars and Actuating Gear.

All the Rotating and Sliding Parts should be kept well greased.

Particular attention should be given to the Sliding Tube taking the lower Raf-wire Supports.

CONTROLS.

With Pilot's Control Stick central the Ailerons should droop ¾".

The inclined Raf-wire, transmitting the load from the Upper Ailerons to the bottom of the Aileron connecting Struts, should be just tight when the Trailing Edges of Upper and Lower Ailerons are parallel to the Trailing Edges of the Main Planes.

With the Pilot's Control Stick central transversely, but leaning forward 6½° to the vertical,* the Elevators should be in direct continuation of Tail Plane, with the latter in mean position.

With Rudder Bar square in Fuselage, the Rudder and Tail Skid should point directly fore and aft, and be square with Machine.

Owing to the position of the Fin Surface the Machine has a tendency to turn to the right, and to counteract this effect a piece of ⅜" diam. elastic shock absorber is attached to the port side of the Rudder Bar. This provides the constant pressure which would otherwise have to be supplied by the foot. The load applied by the elastic is governed by means of a Bowden control adjustment.

The Rudder Control Cables should be adjusted so that backlash is just eliminated. The Cables must not be too tight, or unnecessary loads will be put upon the levers and supports.

The Hinge Joints of both Rudder and Skid should be periodically inspected, and should be kept greased. The Skid parts should be inspected for wear and damage from rough usage.

* When this is the case, the centre line of the upper portion of the Elevator Control Arms should be vertical.

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(150 H.P. R.A.F. 4.A.)

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes (approx.)	42′	7″
Span of Lower Main Planes (approx.)	32′	7½″
Chord of Upper Main Planes	5′	6″
Chord of Lower Main Planes	5′	6″
Incidence of Upper Main Planes		4°
Incidence of Lower Main Planes		4°
Dihedral		3½°
Dihedral Depth (from centre to centre of tops of Front Outer Struts)		6.1″
Stagger		24″
Over-all Length (approx.)	27′	10½″
Height	11′	4½″
Tail Span	14′	0″
Incidence of Tail Plane (with latter in mean position)		1½°

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(150 H.P. R.A.F. 4.A.)

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that all Bolts on Fuselage are securely locked.

See that the Leading Edges of the Main Planes are symmetrical about the centre line of Machine.

Examine the Bracing Wires in the Centre Section for length and tautness, and see that the Split Pins are in position and that all Lock Nuts are tight.

Check the Dihedral.

Check the Stagger.

Check the Incidence.

See that Interplane Struts are straight, undamaged, and streamlined in the direction of flight.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position and that all Lock Nuts are tight.

Examine all Controls, Control Pulleys and Cables, and see that they work freely, and that all Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is set correctly and is square with Machine, and that all Tail Plane Bracing Wires are correct both as to length and tautness, and that all Split Pins are in position and that all Lock Nuts are tight.

Examine Tail Plane Actuating Gear, and see that it works freely.
Examine Rudder and Fins, and see that they are set straight and square with Machine.

Check the setting of the Ailerons and Elevators.

Examine the Undercarriage and Tail Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls and Engine Accessories.

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FIG. 1.

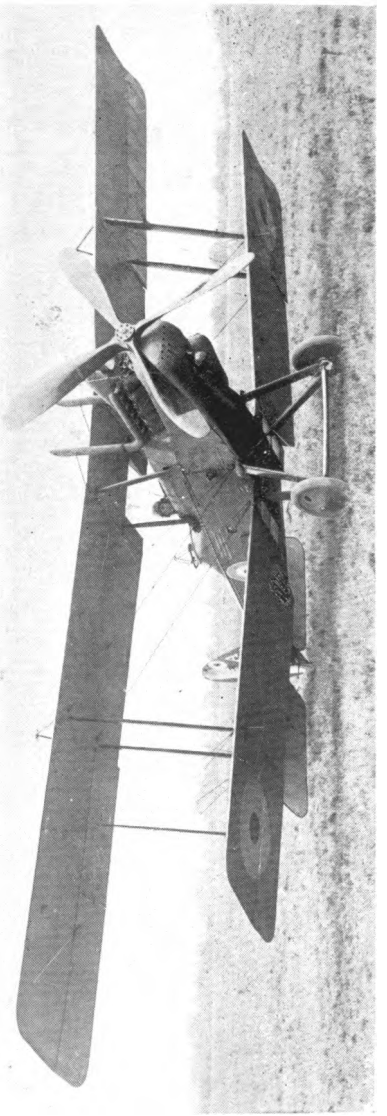

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FIG. 2.

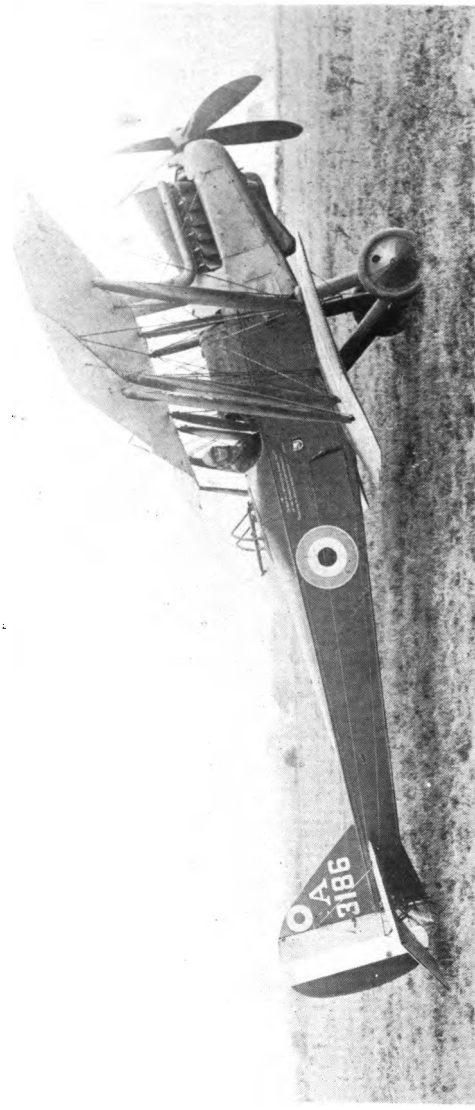

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FIG. 3.

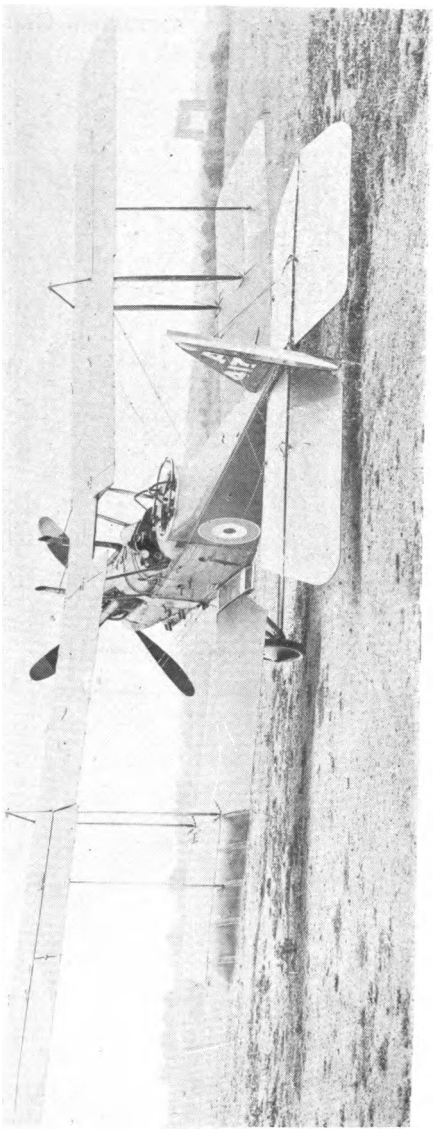

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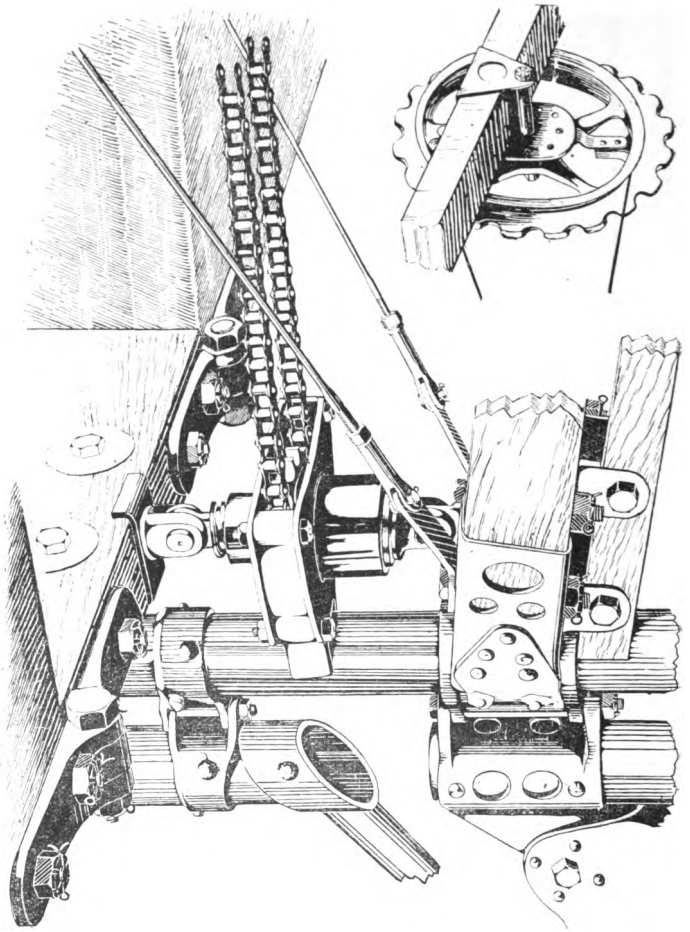
FIG. 4.

TAIL PLANE ACTUATING GEAR.



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RIGGING DIAGRAMS.

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RIGGING NOTES.

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MANUFACTURERS' ORDER OF ERECTION.

---

1. Fuselage assembled and trued up.
2. Undercarriage fitted with Fuselage in inverted position.
3. Lower Centre Section Planes fitted.
4. Rear Fairing of Fuselage fitted and fixed; front Fairing fitted, but not fixed.
5. Seat fitted.
6. Flying Wire Lugs fitted to Fuselage.
7. Oil Tank fitted.
8. Holes drilled for Carburetter Countershaft Bracket and the latter fitted.
9. Engine mounted.
10. Constantinesco Gear fitted.
11. Radiator fitted.
12. Oil and Water Pipes fitted.
13. Vickers Gun Mount and Ammunition Box fitted.
14. Controls fitted.
15. Tail Plane Actuating Gear fitted.
16. Footsteps fitted.
17. Main Petrol Tank fitted.
18. Front Fairing fixed.
19. Instrument Board fitted.
20. Air and Petrol Pipes connected up.

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21. Water and Emergency Petrol Tanks fitted to Upper Centre Section Plane before the latter is fitted to Machine; also the Foster Gun Mount for Lewis Gun.
22. Upper Centre Section Plane fitted with Machine in Flying Position.
23. Leads to Water and Emergency Petrol Tanks connected up.
24. Lower Centre Section Planes covered and doped.
25. Hinge Jaws fitted to Upper and Lower Centre Section Plane Spars.
26. Main Planes attached.
27. Tail Plane fitted and Locking Washers hammered over.
28. Top Cover at Rear of Fuselage attached.
29. Upper Fin fitted.
30. Rudder fitted.
31. Elevators fitted.
32. Controls connected up and adjusted.
33. Bottom Cover at rear of Fuselage attached.
34. Lower Fin fitted.
35. Tail Skid fitted.
36. Engine Cowl fitted.

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TRUING UP THE FUSELAGE (See Fig. 1).

Support the Fuselage so that the Rear Transverse Steel Tube is level transversely, and the Engine Bearers are level longitudinally, as far as possible.

By means of Side Bracing Wires between Front and Rear Transverse Steel Tubes which form attachments for Spars of Lower Main Planes, adjust until the Tubes are parallel.

Check by holding two straightedges, one each side, longitudinally across corresponding points on Front and Rear Transverse Steel Tubes. The *upper* edges of the straightedges should be in line.

Mark the mid points of all Cross Struts, top and bottom.

Insert a Steel Tube to fit without play into the Finpost.

Stretch a centre line below the Fuselage from the *axis* of the Finpost to the *mid* point of the *Rear Transverse Steel Tube.*

Stretch another centre line above the Fuselage from the *axis* of the Finpost to the *mid* point of *Front Top Cross Strut.*

Work from front to rear and true up the bottom Cross Bracing Wires until all mid points of Bottom Cross Struts are in line.

Check by try square at each marked point. The base of the try square should be along the Strut and the marked point on one edge of the blade. The bottom stretched line should just touch the same edge of the blade.

Check for Bottom of Fuselage being square with Rear Transverse Steel Tube by taking measurements from axis of Finpost to lateral extremities of the Tube. Corresponding measurements should be the same on both sides.

Proceed in an exactly similar manner for the Top of the Fuselage.

Mark points on Side Struts at equal vertical distances—5" is a convenient distance—below the *top* face of the Top Longerons.

True up the Side Bracing Wires on one side until all marked points on Side Struts on that side are in line.

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S.E.5A. 200 H.P. HISPANO SUIZA, *continued.*

Check by levelling from marked point to marked point on adjacent Struts. Proceed in exactly the same way for the other side.

Check for their being no wind in the Fuselage as follows :—

Place a straightedge transversely across the Top Longerons above the Front Transverse Steel Tube. Place another straightedge transversely across the Top Longerons at any other point about $2\frac{1}{2}$" from Struts Sockets.

The upper edge of the second straightedge should be in line with the upper edge of the first straightedge.

Check by sighting and repeat for other points. Finally tension the Internal Cross Bracing Wires.

A plumb line dropped from the mid point of a Top Cross Strut should strike the mid point of the corresponding Bottom Cross Strut.

Note.—It is very important that all Tie Rods be cut accurately to length ; otherwise it will be impossible to get the Fuselage true.

TRUING UP THE UNDERCARRIAGE (see Fig. 2).

Adjust Front Cross Bracing Wires making corresponding diagonals equal and check by trammel.

PLACING MACHINE IN FLYING POSITION (see Figs. 2 & 3).

Before truing up the Upper Centre Section Plane and attaching and truing up the Main Planes it is necessary to get the Machine in Flying Position. To do this, block the Machine up on a trestle placed under the Engine Bearers and support the Tail on another trestle.

The Machine is in Flying Position when the Engine Bearers are level longitudinally and the Front and Rear Transverse Steel Tubes which form attachments for Spars of Lower Main Planes are level transversely.

When this is the case the *Incidence* of the Lower Centre Section Planes should be 5°.

Level transversely by spirit level over Rear Transverse Steel Tube and make any adjustments by packing blocks under the front trestle. Level longitudinally by spirit level over the Engine Bearers and make any adjustments by raising or lowering Tail.

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TRUING UP THE CENTRE SECTION (see Fig. 2).

Note.—Before fitting the Fairing for the Centre Section Struts (Steel Tubes) it is necessary to fit the Water Pipe to the Water Tank and Pitot Tubes in the Fairing for the Starboard Front Centre Section Strut and the Petrol Pipe (for the Emergency Tank) in the Fairing for the Port Front Centre Section Strut. The Tanks and Foster Gun Mount for Lewis Gun should be fitted to the Upper Centre Section Plane before the latter is fitted to the Machine.

Note.—When fitting the Tanks it is important to ensure that all Split Pins are in position, and that the Tanks are completely covered and doped.

The *Stagger* of the Upper Centre Section Plane is adjusted by the Side Bracing Wires and should be 18″.

Check by dropping plumb lines from the centres of lateral extremities of Upper Centre Section Front Spar.

The horizontal *fore* and *aft* distance between the centres of the lateral extremities of Front Spar of Lower Section Planes and the plumb lines should be 18″.

Adjust the Upper Centre Section Plane to be symmetrical about the vertical line of Machine by Front and Rear Cross Bracing Wires.

Check for symmetry by measuring the horizontal transverse distance between the plumb lines dropped from the lateral extremities of Front Spar of Upper Centre Section Plane, and the edges of straightedges placed longitudinally across corresponding points on one side of Front and Rear Transverse Steel Tubes which form attachments for Spars of Lower Main Planes.

Corresponding measurements should be the same on both sides.

ATTACHING THE MAIN PLANES.

The Hinge Jaws must be removed from the Main Planes and fitted to both Upper and Lower Centre Section Spars by the Hinge Pins as the Main Planes cannot be assembled with the Hinge Jaws bolted to the Spars.

The Lower Main Planes are bolted in position and the Landing Wires loosely connected.

The Upper Main Planes are then lifted and bolted in position.

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S.E.5A. 200 H.P. HISPANO SUIZA, *continued.*

the Interplane Struts fitted into their Sockets and the Flying, Deflection and Incidence Wires loosely connected.

TRUING UP MAIN PLANES (See Figs. 3 & 4).

The *Dihedral* is 5° for both Upper and Lower Main Planes.

Check by straightedge along the Front Spars and Abney level.

A line stretched from the *tops* of the front Outer Struts should be 7.55″ vertically above the Upper Centre Plane ; check at lateral extremities of latter.

The *Stagger* is 18″ throughout.

Check by measuring the horizontal fore and aft distance between the Leading Edge of Lower Main Planes and plumb lines dropped from the Leading Edge of Upper Main Planes. These measurements should be 18″ at each point checked.

The *Incidence* is 5° throughout for both Upper and Lower Main Planes. Check by Abney level and straightedge placing the latter from Leading Edge to Trailing Edge at Ribs.

Check for Leading Edges being parallel by placing straightedges across the Leading Edges of Upper and Lower Main Planes.

Any two of these straightedges should be in line.

The Leading Edges of both Upper and Lower Main Planes should be symmetrical about the centre line of Machine.

Check by taking measurements from Top and Bottom Sockets of Rear Outer Struts to axis of Finpost. Corresponding measurements should be the same on both sides.

Check also by taking measurements from Top and Bottom Sockets of Front Outer Struts to front centre of Engine Shaft.

Corresponding measurements should be the same on both sides.

FIXING THE EMPENNAGE (See Fig. 5).

Fit and bolt the Tail Plane in position, not forgetting to hammer over the Locking Washers.

Fit and bolt the Upper Fin in position.

Hinge the Rudder in position.

Hinge the Elevators in position.

Fit and bolt the Lower Fin in position.

Fit the Tail Skid in position.

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S.E.5A. 200 H.P. HISPANO SUIZA, *continuea.*

Take care to insert all Split Pins and Lock up all Turnbuckles on Control Cables which are covered by Rear Covering of Fuselage.

The Tail Plane must be square with Machine. Check by taking measurements from Bottom Sockets of Rear Outer Struts to lateral extremities of Rear Spar of Tail Plane. Corresponding measurements should be the same on both sides.

The Fins should point directly fore and aft and be square with Machine.

CONTROLS.

With Pilot's Control Stick central the Ailerons should droop $\frac{3}{4}''$ approximately.

With Knob of Hand Wheel, for Tail Plane Actuating Gear, opposite the word "normal" on Strut the central line of Tail Plane should be at an *Incidence* of 5°.

With rear end of Tail Plane in extreme top position the Tail Plane should have a negative *Incidence* of 2°.

With Elevators horizontal, the Pilot's Control Stick should lean forward 10° from the vertical.

With Rudder Bar square in Fuselage the Rudder and Tail Skid should point directly *fore* and *aft* and be square with Machine.

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LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	26′ 7½″
Span of Lower „	26′ 7½″
Chord of Upper Main Planes	5′ 0″
Chord of Lower „	5′ 0″
Incidence of Upper Main Planes	5°
Incidence of Lower „	5°
Gap	4′ 7″
Stagger	18″
Dihedral	5°
Overall Length	20′ 11″
Height	9′ 6″
Droop of Ailerons	¾″
Incidence of centre line of Tail Plane with Knob on Hand Wheel opposite the word "Normal" on Strut	5°

With Pilot's Control Stick leaning forward 10° from the vertical Elevators are horizontal.

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(200 H.P. HISPANO SUIZA).

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that Leading Edges of Main Planes are symmetrical about centre line of Machine.

Examine the Bracing Wires for length and tautness in the Centre Section and see that all Split Pins are in Position and that all Lock Nuts are tight.

Check the Dihedral.

Check the Stagger.

Check the Incidence.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position and that all Lock Nuts are tight.

Examine all Control Pulleys and Cables, and see that they work freely and that all Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is set correctly and is square with Machine and that all Bracing Wires are correct both as to tautness and length and that all Lock Nuts are tight.

See that the Tail Plane Actuating Gear works freely.

Examine Rudder and Fins and see that they are set straight and square with Machine.

Examine the setting of the Ailerons and Elevator.

Examine Undercarriage and Skid.

Examine Tank Mountings, Engine Controls and Engine accessories and see that Pins through Control Arms and Levers are not worn.

See that Security Bolts for Gun and Mount are all tight.

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Fig. 1.

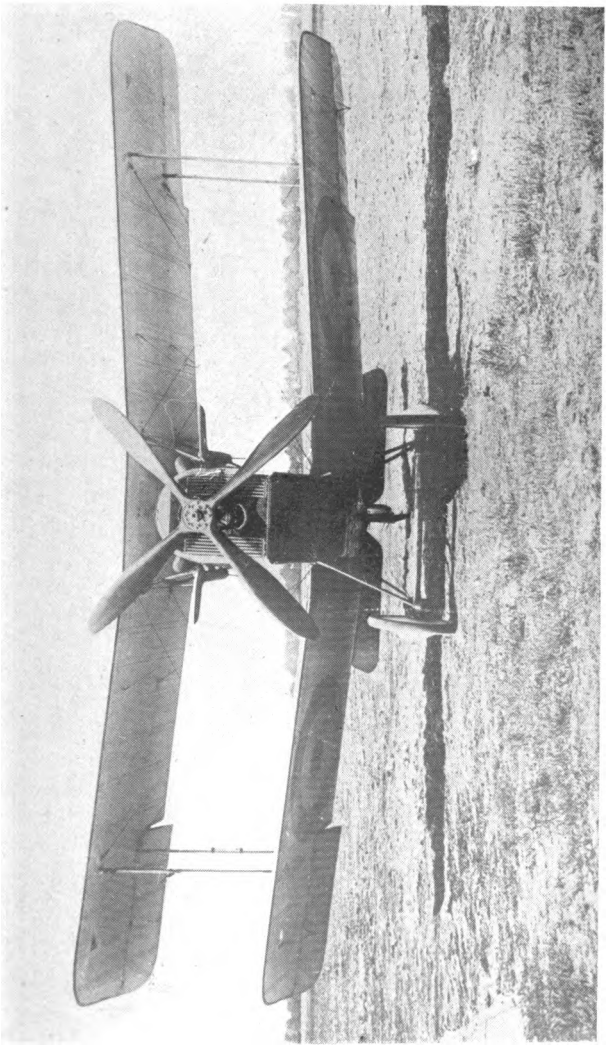

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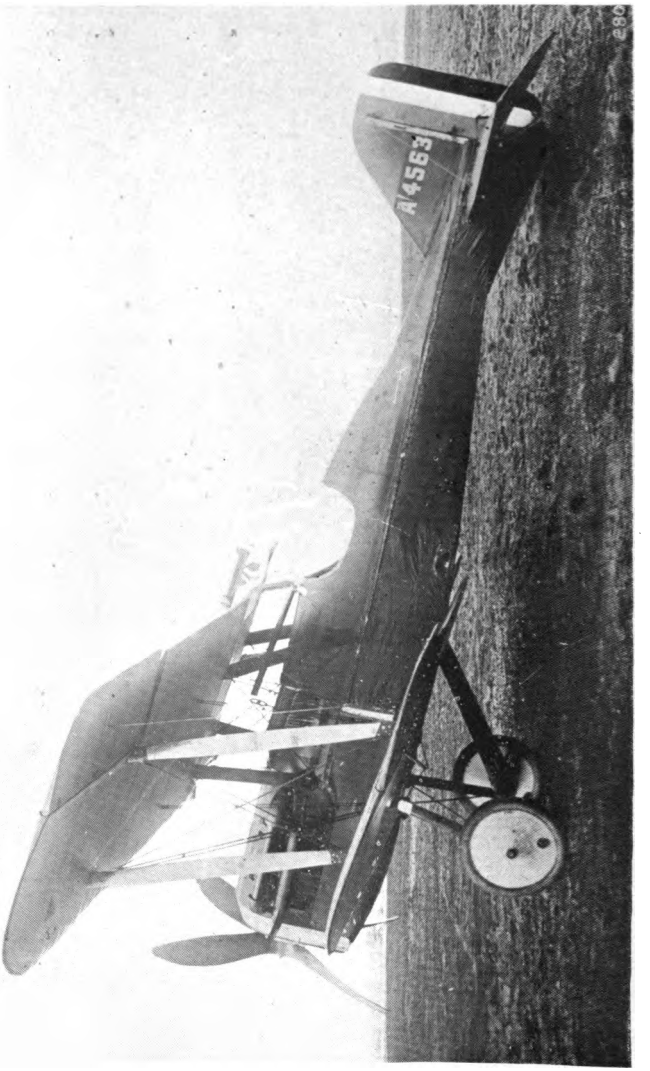
FIG. 2.



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T.5. S.E.5A. (200 H.P. HISPANO-SUIZA.)

FIG. 3

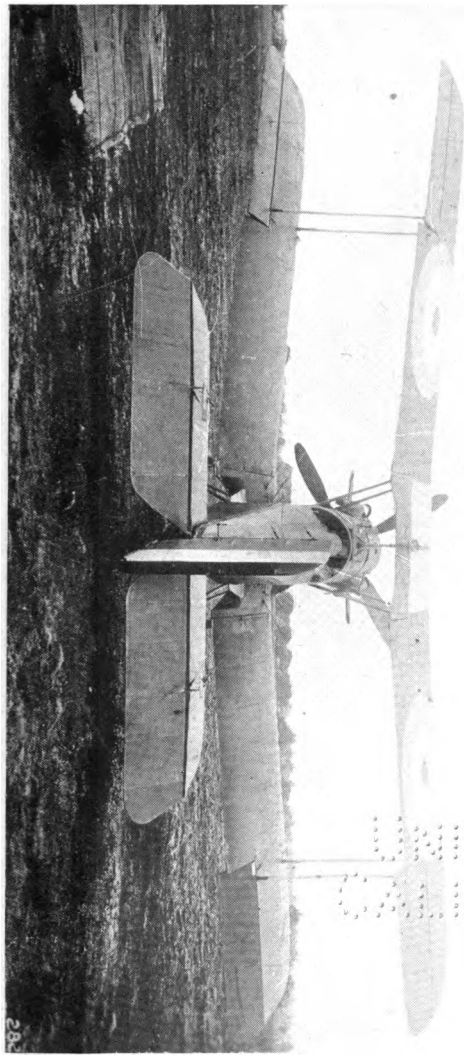

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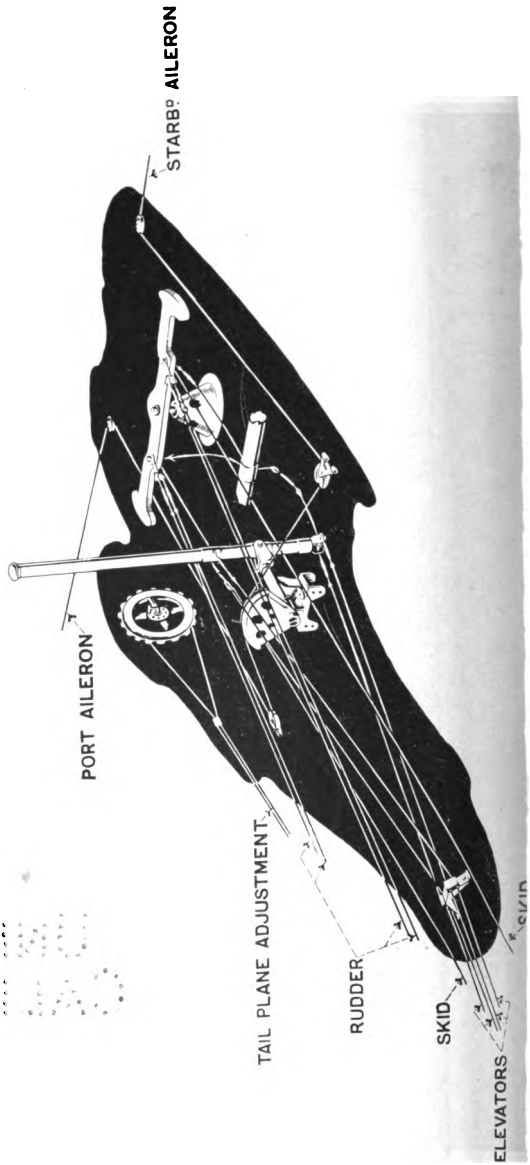
FIG. 4.



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S.E.5A.

(200 H.P. HISPANO SUIZA.)

RIGGING DIAGRAMS.

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SOPWITH PUP.
(80 H.P. LE RHONE).
(100 H.P. MONOSOUPAPE).

RIGGING NOTES.

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SOPWITH PUP.

(80 H.P. LE RHONE.)

(100 H.P. MONOSOUPAPE.)

RIGGING DIAGRAMS.

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SOPWITH PUP.

(80 H.P. LE RHONE).

(100 H.P. MONOSOUPAPE).

MANUFACTURERS' ORDER OF ERECTION.

1. Fuselage assembled and trued up.
2. Tail Skid fitted.
3. Fairing, Dashboard, and Deck fitted
4. Controls fitted in front of Fuselage.
5. Undercarriage fitted.
6. Machine erected and trued up in Flying Position, with Main Planes and Empennage in skeleton.
7. Controls loosely connected.
8. Main Planes and Empennage dismantled.
9. Petrol Tanks fitted.
10. Fuselage covered and doped.
11. Engine Mounted and Engine Accessories and Controls fitted.
12. Gun Magazine and Shoots fitted.
13. Press Plate at bottom of first bay fitted.
14. Oil Tank fitted.
15. Gun and Actuating Gear fitted.
16. Centre Section fitted (after being covered and doped).
17. Wheels and Shock Absorbers fitted on Undercarriage.
18. Cowling fitted.
19. Main Planes and Empennage fitted (after being covered and doped).
20. Controls connected up and adjusted.

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(80 H.P. LE RHONE).
(100 H.P. MONOSOUPAPE).

TRUING UP FUSELAGE.

The Side Struts are numbered from front to rear.

With Fuselage true and in Flying Position, the Top Longerons and Top Transverse Struts are horizontal throughout. Place the Fuselage on two trestles, one being placed under the first bay and the other under the ninth bay.

Trammel and adjust the Internal Cross Bracing Wires until the diagonals in the transverse sections through Nos. 1 and 8 Side Struts are respectively equal.

Mark points on Nos. 1 to 8 Side Struts 14¾" vertically below the upper surface of the Top Longerons. These points will be in the horizontal plane through the Thrust Line when the Fuselage is true.

Lightly clamp a straightedge transversely across No. 1 Side Struts, so that the marked points coincide with the *upper edge*.

Lightly clamp a straightedge transversely across No. 8 Side Struts, so that the marked points coincide with the *lower edge*, on account of these points being close to the Bottom Longerons.

On each straightedge mark a point midway between each pair of Side Struts, and mark two other points, one on each side of the mid point and about 1′ 6″ from it.

From these points stretch two lines *outside* the Fuselage, one on each side, from the *upper edge* of the front straightedge to the *lower edge* of the rear straightedge.

Pack up the Fuselage until the upper edge of the front straightedge and the lower edge of the rear straightedge are on the same horizontal line when viewed from the side. Check by spirit level and long straightedge.

The upper edge of the front straightedge, the lower edge of the rear straightedge and the two side lines are now in the *horizontal plane* through the Thrust Line.

Stretch a centre line from the Sternpost Lower Socket to the *middle point* of the front straightedge. This line will be *inside* the Fuselage.

Mark the mid points of all Top and Bottom Transverse Struts.

By means of light frames attached to the trestles stretch a longitudinal line beneath the Fuselage and about 1′ 6″ *below* it. This line is accurately centred in position by means of plumb lines dropped from a plug in the upper socket of the sternpost and from a centre point of the front straightedge.

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This lower stretched line, the *internal* stretched line, and the mid points of the Top and Bottom Transverse Struts will all be in the *vertical plane* through the Thrust Line when the Fuselage is true.

To true up proceed as follows:—

(a) Adjust Internal Cross Bracing Wires so that corresponding diagonals are equal at each Transverse Section. (Transverse Sections 1 and 8 were trued up before the straightedges were attached.) Check by trammel.

(*b*) Adjust Top and Bottom Cross Bracing Wires until all the mid points on the Top and Bottom Transverse Struts are in line with the *Internal* and *Lower* stretched lines. Check by dropping a plumb line from the mid point of each of the Top Transverse Struts. This plumb line should just touch both stretched lines, and also the mid point of the Bottom Transverse Strut in the same Transverse Section.

(*c*) Adjust Side Bracing Wires on both sides until the marked points on all Side Struts are in line with the two *outer* stretched lines and all Side Struts are vertical. Check the marked points by sighting them in between the two *outer* stretched lines.

TRUING UP THE UNDERCARRIAGE.

The Undercarriage should be symmetrical about the vertical centre line of the Machine.

Adjust the Undercarriage Cross Bracing Wires until the diagonals between corresponding gauge points on the Front Undercarriage Struts are equal. Check by trammel.

The axle is jointed at the centre. Adjust the Centre Vertical Bracing Wire until the two portions of the axle are in line. Check by straightedge.

The axle should be at right angles to the longitudinal centre line of the Machine. Check by taking measurements from the lower socket of the Sternpost to the Axle End Collar of the Undercarriage Wheels. These measurements should be the same on both sides.

PLACING MACHINE IN FLYING POSITION.

Before truing up the Centre Section and attaching the Main Planes it is necessary to get the Machine in Flying Position.

To do this, block up the Machine under the Undercarriage Struts and support the Tail on a trestle placed near the Sternpost.

The Machine is in Flying Position when the Top Longerons are level transversely and longitudinally. The Spars at the bottom of the Fuselage also will be level transversely.

Level transversely by spirit level and straightedge placed across the Top Longerons, and make any adjustments by packing blocks under the Undercarriage Struts.

Level longitudinally by spirit level placed on the Top Longerons, and make adjustments by raising or lowering the Tail.

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TRUING UP CENTRE SECTION.

The Centre Section should be symmetrical about the vertical centre line of the Machine when viewed from the front.

Adjust transversely by Centre Section Front Cross Bracing Wires until corresponding diagonals are equal. Check by trammel.

Adjust longitudinally by Centre Section Side Bracing Wires until correct Incidence and Stagger are obtained.

The Stagger of the Centre Section is 18″. This can be adjusted *after* the Lower Main Planes have been fitted.

Check by dropping plumb lines from the Leading Edge of the Centre Section. The fore and aft horizontal distance of the Leading Edge of the Lower Main Planes from the plumb lines should be 18″.

ATTACHING THE MAIN PLANES.

Place the Lower Main Planes in position and insert the Securing Rod on each side from the *rear*.

Push the latter Rod well in, and secure it to the *Ribs* at the roots of the Main Planes by nuts and bolts, not forgetting to insert the *Split-pins*.

Loosely connect the Landing Wires.

Lift the Upper Main Planes in position, insert the Securing Rods from the *front*, and after pushing the Rods well in, secure the front of the Rods to the Leading Edges of the Main Planes.

Loosely connect Flying and Incidence Wires.

TRUING UP MAIN PLANES.

Drop plumb lines from four points, two each side, from the Leading Edge of the Upper Main Planes. True up until—

(*a*) All plumb lines are in line viewed from the side.

(b) The Leading Edges are of the Lower Main Planes are symmetrical about the centre line of Machine. Check by taking measurements from Bottom Sockets of Front Outer Struts to Rudderpost and Propeller Boss. Corresponding measurements should be the same on both sides.

(c) The *Dihedral* of the Main Planes is 3°. Adjust by Front Landing Wires and check by Abney level and straight-edge along the Front Spar.

(d) The *Stagger* of the Main Planes is 18″ throughout. Adjust by Incidence Wires and check by measuring the fore and aft horizontal distances from the Leading Edge of the Lower Main Planes to the plumb lines dropped from the Leading Edge of the Upper Main Planes.

(e) The *Incidence* is 1½° throughout. Adjust by Incidence, Rear Landing, and Rear Flying Wires, and check by Abney level and straightedge, taking care to place the latter from Leading Edge to Trailing Edge at Ribs.

(*f*) There is no "Wash in" or "Wash out."

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FIXING THE EMPENNAGE.

Bolt the Tail Plane in position and connect the Tail Plane Bracing Wires.

True up the Tail Plane to be level transversely.

Check by spirit level along the Front Spar.

Check for Tail Plane being square with Machine by taking measurements from Tops of Side Struts No. 7 to lateral extremities of Hinged Tube of Tail Plane and to outer Hinges of Elevator.

These measurements should be the same on both sides.

The Incidence of the Tail Plane is 1½° for 80 H.P. Le Rhone and 2½° for 100 H.P. Monosoupape. Check by using a straightedge with two small blocks attached. These blocks must be of such dimensions that when one is on the Front Spar and the other on the Hinged Tube of the Tail Plane the *upper edge* of the straightedge is parallel to the fore and aft centre line of the Tail Plane.

The Incidence can be measured by an Abney level over the straightedge with Machine in Flying Position.

Bolt the Fin in position.

Hinge the Rudder to the Sternpost and Fin, not forgetting to insert the Split-pins; similarly hinge the Elevators to the Tail Plane Hinged Tube.

CONTROLS.

Connect up the Controls and adjust them so that—

(*a*) With the Pilot's Control Stick vertical there is no droop on either the Ailerons or the Elevators.

(*b*) The Rudder and Tail Skid should point directly *fore* and *aft* and be square with Machine when the Rudder Bar is square in Fuselage.

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SOPWITH PUP.
(80 H.P. LE RHONE).
(100 H.P. MONOSOUPAPE).

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes ..... approx.	26′	6″
Span of Lower Main Planes ..... approx.	26′	6″
Chord of Upper Main Planes	5′	1½″
Chord of Lower Main Planes	5′	1½″
Incidence of Upper Main Planes		1½°
Incidence of Lower Main Planes		1½°
Stagger		18″
Dihedral, Upper Main Planes		3°
Dihedral, Lower Main Planes		3°
Overall Length	19′	3¾″
Height	9′	3½″
Incidence of Tail Plane (80 H.P. Le Rhone) ...		1½°
Incidence of Tail Plane (100 H.P. Monosoupape)		2½°
Droop of Ailerons (with Pilot's Control Stick vertical)	Nil.	
Droop of Elevators (with Pilot's Control Stick vertical)	Nil.	

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SOPWITH PUP.
(80 H.P. LE RHONE).
(100 H.P. MONOSOUPAPE).

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Leading Edges of the Main Planes are symmetrical about centre line of Machine.

Check the Stagger.

Examine the Bracing Wires for length and tautness in the Centre Section, and see that the Split-pins are in position, and that all Lock Nuts are tight.

Check the Dihedral.

Check the Incidence.

See that the Interplane Struts are straight.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split-pins are in position.

Examine all Controls, Control Pulleys and Cables, see that they work freely, and that Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is set correctly and is square with Machine, that Tail Plane Bracing Wires are correct both as to tautness and length, that all Split-pins are in position, and that Lock Nuts are tight.

Examine Rudder and Fin and see that they are set straight and square with Machine.

See that there is no Droop on Ailerons and Elevators.

Examine Undercarriage and Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories

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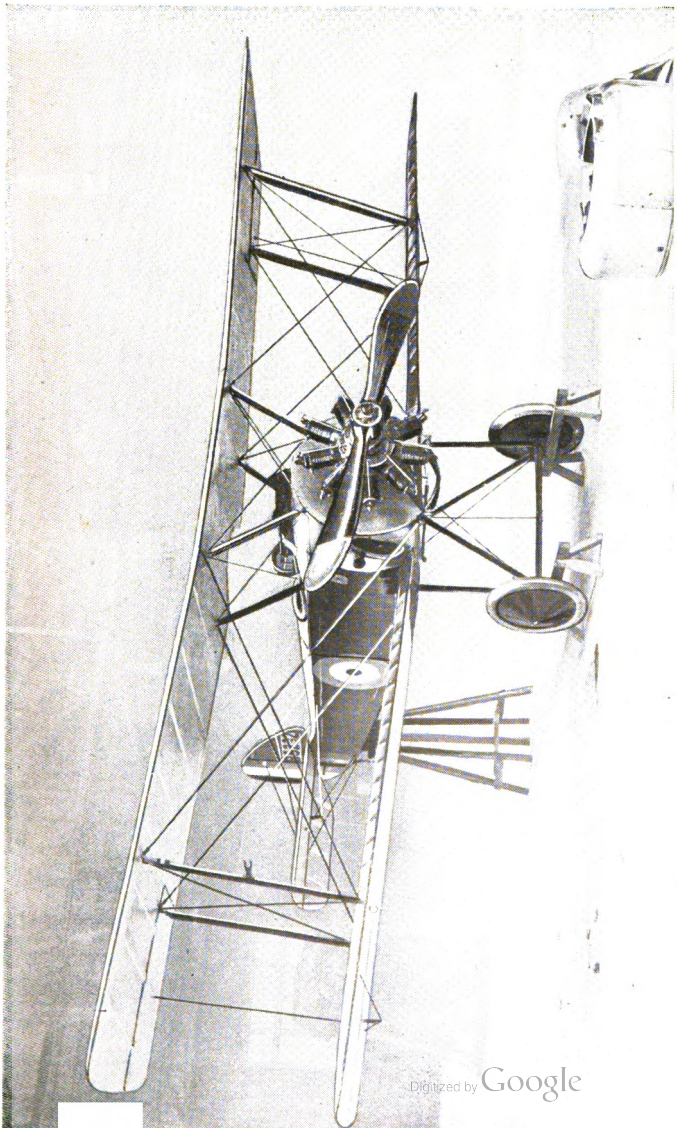
SOPWITH PUP (100 H.P. MONOSOUPAPE.)

FIG. 1. MACHINE IN FLYING POSITION.



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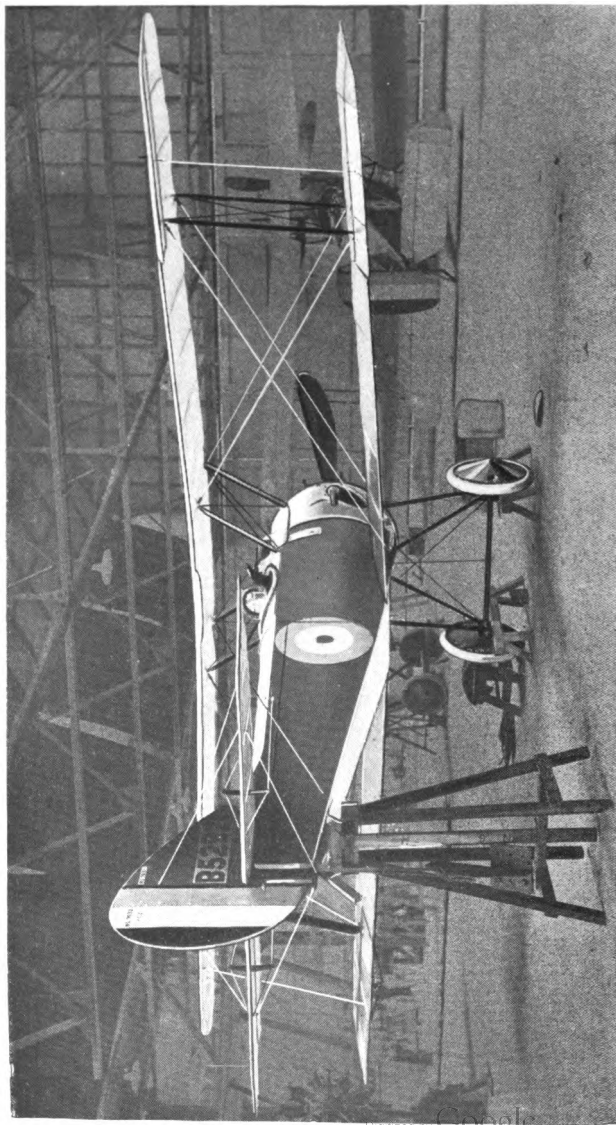
SOPWITH PUP (80 H.P. Le Rhone) (100 H.P. Monosoupape.)

Fig. 2. Machine in Flying Position.



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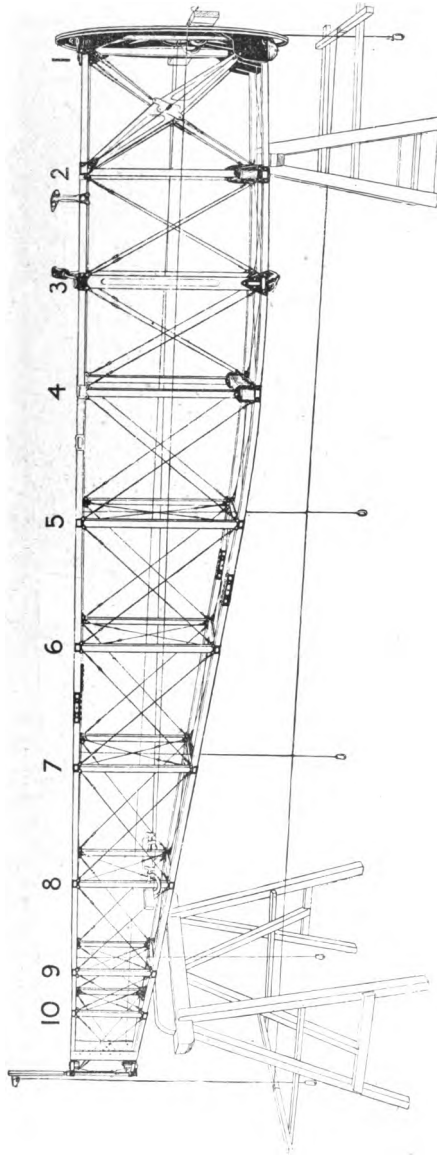

Fig. 3. Truing up Fuselage.

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SOPWITH PUP (80 H.P. LE RHONE) (100 H.P. MONOSOUPAPE.)

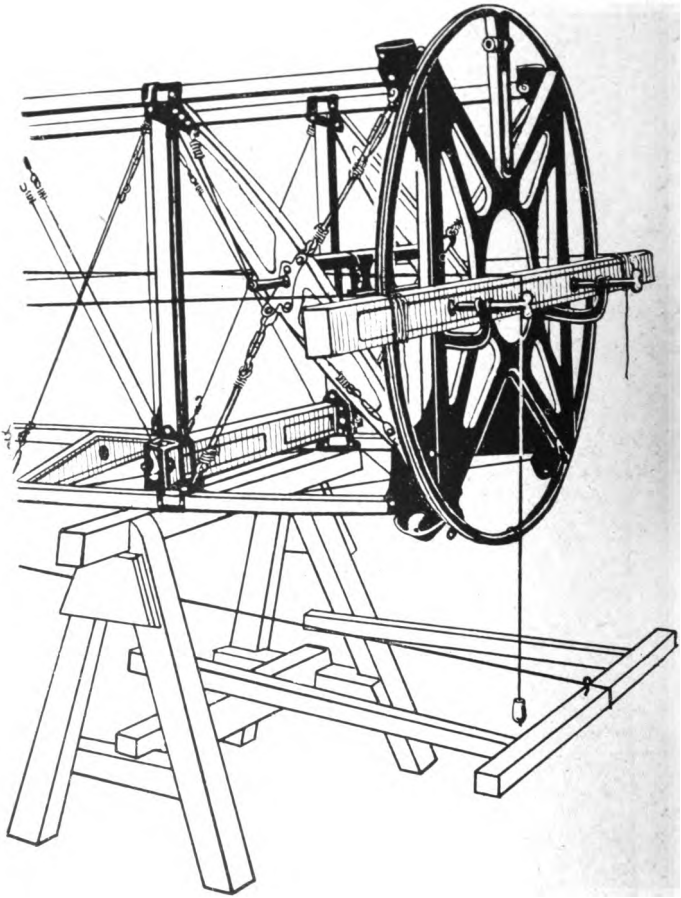

FIG. 4. TRUING UP FUSELAGE.

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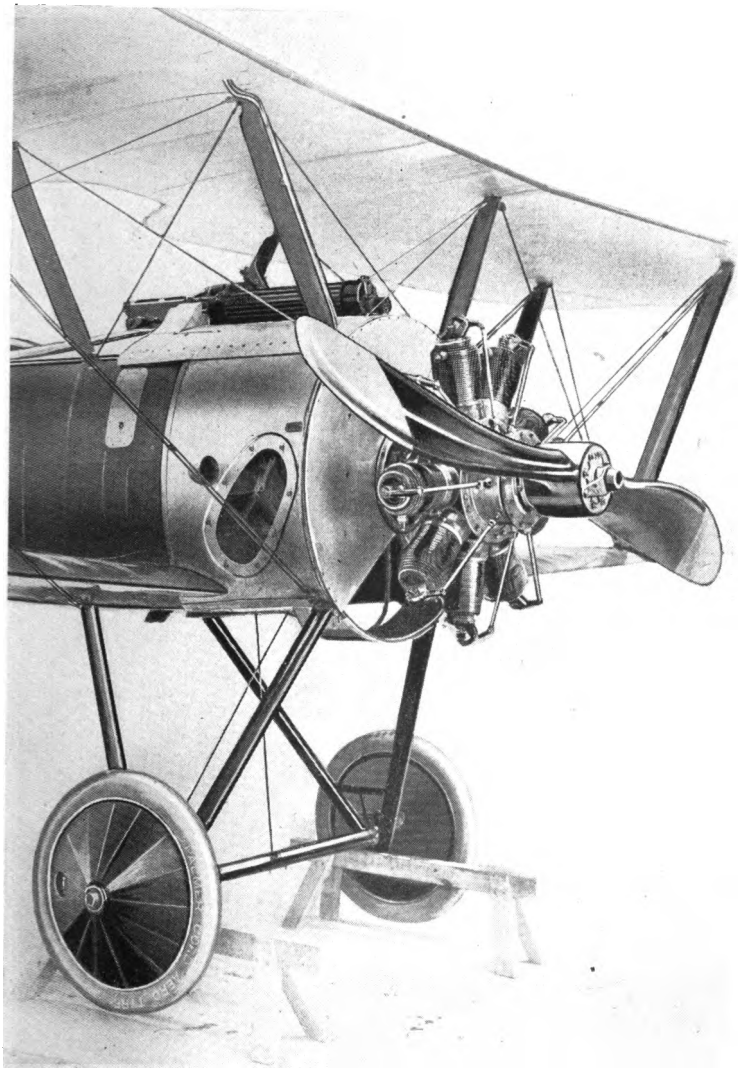
SOPWITH PUP (100 H.P. MONOSOUPAPE.)

FIG. 5. CENTRE SECTION AND UNDERCARRIAGE.



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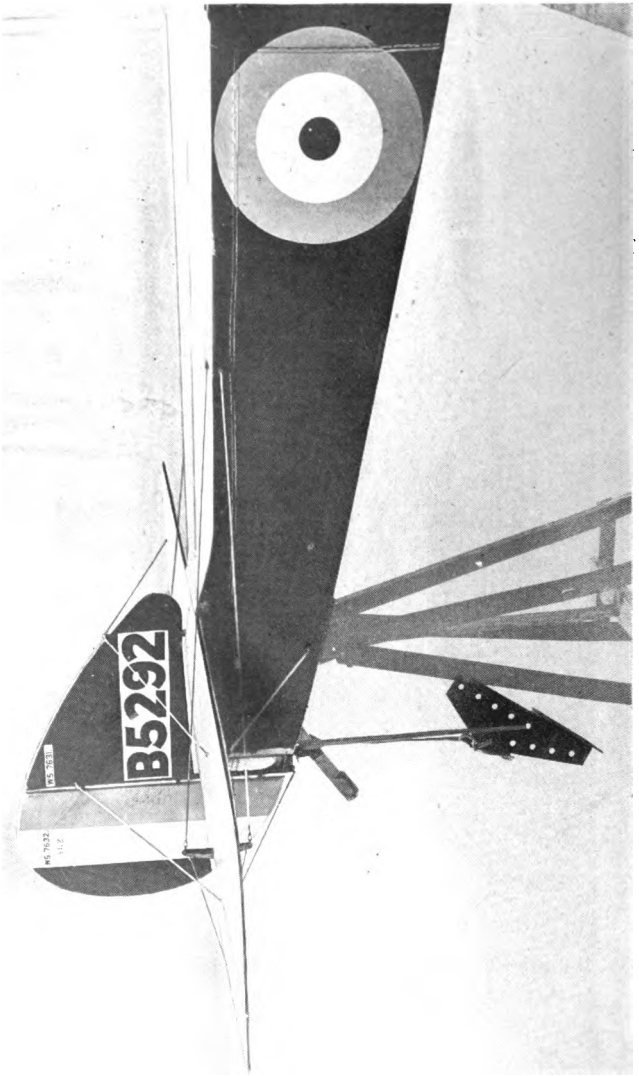
SOPWITH PUP (80 H.P. Le Rhone) (100 H.P. Monosoupape.)

Fig. 6. Empennage.



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T.5. SOPWITH PUP (80 H.P. Le Rhone)
(100 H.P. Monosoupape).
Fig. 7.

(Control Diagram.)

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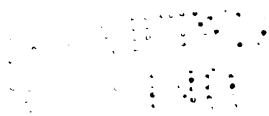

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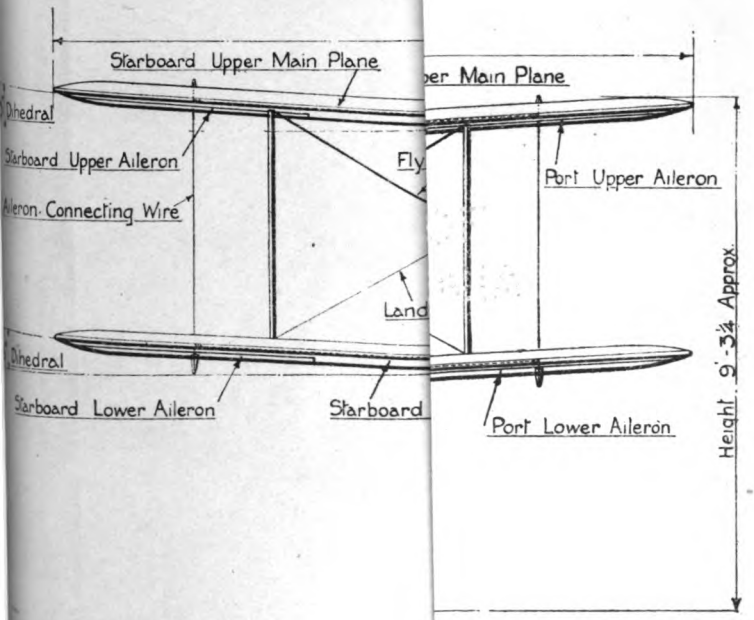

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SOPWITH $1\frac{1}{2}$ STRUTTER.

110 H.P. CLERGET.

RIGGING NOTES.

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SOPWITH 1½ STRUTTER.

(110 H.P. CLERGET.)

MANUFACTURERS' ORDER OF ERECTION.

---

1. Fuselage assembled and trued up.
2. Lower Centre Section fitted.
3. Pilot's Control Stick, Tail Plane Actuating Gear, Air Brake Control, Rudder Bar, Main Petrol and Gravity Tanks, Side Fairing, Decking, Car Cases, Tool Boxes and Dashboard (less Instruments), fitted.
4. All Accessories, including Instruments, Oil, Petrol and Air Service fitted.
5. Empennage fitted in skeleton for adjustment of Controls and Tail Plane Actuating Gear.
6. Lighting Wires, Right and Left Hand Magneto Switches, Control Stick Cut Out and all Ignition Wires fitted.
7. Oil Tank fitted.
8. Front Gun and Actuating Gear fitted.
9. Undercarriage fitted.
10. Engine Mounted.
11. Upper Centre Section K. Rib fitted.
12. All bolts rivetted or pinned.
13. Fuselage covered and doped.
14. Main Planes fitted.
15. All Cowls fitted.
16. Empennage dismantled, covered, doped and refitted.
17. Controls adjusted.

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SOPWITH 1½ STRUTTER.
(110 H.P. CLERGET.)

TRUING UP FUSELAGE.

With Fuselage true and in Flying Position the Top Longerons are level throughout. The Front Engine Plate, Side Struts 1, and Side Struts 4 to 11 are vertical. To true up, support the Fuselage on two trestles, one placed under the first bay, and the other under the Tail. Pack up the supports and level the Top Longerons as far as possible.

Mark points on Side Struts, 15¼" vertically *below* the *top face* of the Top Longerons. These points will be along the Thrust Line in side elevation when the Fuselage is true.

Lightly clamp a straightedge transversely across the Front Engine Plate, the marked points on the No. 1 Side Struts to be on the *upper edge*.

Lightly clamp another straightedge transversely across Side Struts No. 10, the marked points to be on the *lower edge*, on account of these points being close to the Bottom Longerons. Stretch two lines, one each side, from the *upper edge* of the front straightedge to the *lower edge* of the rear straightedge.

These lines will be *outside* the Fuselage.

Stretch a centre line from the *axis* of the Rudderpost to the *middle point* of the front straightedge. This line will be *inside* the Fuselage.

Mark the middle points of all Cross Struts, top and bottom.

Proceed to true up as follows :—

(*a*) Adjust Internal Bracing Wires so that diagonals are equal at each section.

(*b*) Adjust Side Bracing Wires so that the Top Longerons are level transversely and longitudinally.

Check for transverse level by a spirit level over straightedges placed transversely across the Top Longerons.

Check for longitudinal level, using a long straightedge over the faces of the transverse straightedges for this purpose.

Check for marked points on Side Struts being in the same horizontal plane as the two *outer* stretched lines, using a try-square at each Strut.

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Sopwith 1½ Strutter (110 H.P. Clerget).

The *base* of the trysquare should be along the Strut and the marked point should be on the *upper edge* of the blade.

The *outer* stretched line should just touch the *same* edge of the blade.

(*c*) Adjust by Top and Bottom Bracing Wires until all marked points on Cross Struts and the *internal* stretched line are in the same vertical plane.

Check by dropping a plumb line from the marked point on a Top Cross Strut. This line should touch the *internally* stretched line and strike the marked point on the Bottom Cross Strut.

TRUING UP THE UNDERCARRIAGE.

The Undercarriage is symmetrical about the vertical centre line of Machine.

True up by Undercarriage Bracing Wires until corresponding diagonals are equal.

Check by trammel.

PLACING MACHINE IN FLYING POSITION.

Before truing up the Centre Section and attaching the Main Planes it is necessary to get the Machine in Flying Position.

To do this block the Machine up under the Undercarriage Struts and support the Tail on a trestle placed near the Sternpost.

The Machine is in Flying Position when the Top Longerons are level transversely and longitudinally.

Level transversely by spirit level and straightedge across the Top Longerons and make any adjustments by packing blocks under the Undercarriage Struts.

Level longitudinally across the Top Longerons in rear of the Engine. Make adjustments by raising or lowering Tail.

TRUING UP CENTRE SECTION.

The Upper Centre Section (K. Rib) being small, great care must be exercised in setting it symmetrically about the vertical centre line of Machine.

It cannot be adjusted transversely and so the Steel Struts must be cut accurately to length.

It is adjusted longitudinally by the front Centre Section Drag Wires and the Rear Centre Section Anti-Drag Wires.

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Sopwith 1½ Strutter (110 H.P. Clerget).

It is set correctly with respect to the Fuselage when a plumb line dropped from the centre of the Front Spar Hole in the K. Rib is 4" in rear of the centres of Bottom Sockets, of the Front Centre Section Struts, fixed on the Top Longerons.

To check mark points along the Top Longerons 12" in rear of the centres of the latter Sockets.

Place a straightedge transversely across the Top Longerons, the marked points to be on one edge of the straightedge.

Mark points on the Upper Centre Section Plane (K. Rib) 8" in rear of the centre of the Front Spar hole.

A plumb line dropped from the latter point should cut the edge of the straightedge placed across the marked points on the Top Longerons. This will ensure that the Upper Centre Section has the correct *Stagger* (24").

ATTACHING THE MAIN PLANES.

The Lower Main Planes are placed in position ; the Securing Rods are inserted, fixed in position, and the Landing Wires loosely connected.

The Upper Main Planes are then lifted into position, the Securing Rod inserted through the Upper Centre Section Plane (K. Rib), and fixed in position.

The Outer Struts are fitted and the ½ Struts bolted in position.

The Flying and Incidence Wires are loosely connected.

The Drag Wires are also loosely connected.

TRUING UP THE MAIN PLANES.

Drop plumb lines from four points, two each side, on the Leading Edge of the Upper Main Planes.

True up until :—

(*a*)*All plumb lines are in line, viewed from the side.

Check for Main Planes being symmetrical about centre line of Machine by taking measurements from Bottom Sockets of Front Outer Struts to centre of Propeller Boss, and to Rudder-post. Corresponding measurements should be the same on both sides.

---

*On account of dihedral the inner lines will be slightly in front of the outer lines, but for practical purposes all can be taken as being in one line.

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Sopwith 1½ Strutter (110 H.P. Clerget).

(*b*) The *Dihedral* is 2° 23′ on Front and Rear Spars for both Upper and Lower Main Planes.

Check by Abney level and straightedge along the Spars.

(*c*) The *Stagger* is 24″ throughout. Check by measuring the *fore* and *aft* horizontal distance between the plumb lines, dropped from the Leading Edge of the Upper Main Planes, and the Leading Edge of the Lower Main Planes.

(*d*) The *Gap* is 5′ 4¾″ from the Roots of the Lower Main Planes to the Wing Tips. Check by holding a lath in a vertical position to touch the Leading Edge of the Upper Main Planes and by a levelled straightedge from the Leading Edge of the Lower Main Planes to the vertical lath. The *Gap* can then be measured directly.

(*e*) The *Incidence* is 2° 10′ throughout for both Upper and Lower Main Planes.

Check by Abney level and straightedge, taking care to place the straightedge from Leading Edge to Trailing Edge at *Ribs*.

FIXING THE EMPENNAGE.

Slip the Socket on the Rear Spar (Tube) of the Tail Plane on to Adjusting Column and secure to latter by *Nut* and *Bolt*, and insert the *Split Pins*.

At the same time slip the two Pivot Tubes on the Front Spar of the Tail Plane into the Sockets on the Top Longerons, securing them by *Nuts* and *Bolts* and inserting the *Split Pins*. Bolt the Fin in position.

Hinge the Rudder to the Fin and Sternpost, not forgetting to insert the *Split Pins*.

Similarly hinge the Elevators to the Tail Plane.

Loosely connect the Tail Plane Bracing Wires.

By means of the latter true up until Tail Plane is level transversely, and square with Machine, and Rudderpost is vertical.

Level laterally by Spirit Level over Front and Rear Spars and check the Rudderpost for being vertical by plumb line. Check for Tail Plane being square with Machine by taking measurements from the Bottom Sockets of the Rear Outer Struts to the lateral extremities of the Rear Spar of Tail Plane. These measurements should be the same on both sides

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Sopwith 1½ Strutter (110 H.P. Clerget).

The Fin should be square with Machine and point directly *fore* and *aft*.

CONTROLS.

With Pilot's Control Stick Central the Ailerons should droop $\frac{3}{8}$" below the Trailing Edges of the Main Planes, and the Elevators should be in continuation with the Tail Plane with the latter in Neutral Position (i.e., at an *Incidence* of 2°).

With Tail Plane Actuating Gear in Neutral position the Incidence of the Tail Plane is 2°.

With Rudder Bar square in Fuselage, the Rudder and Tail Skid should point directly *fore* and *aft*, and be square with Machine.

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SOPWITH 1½ STRUTTER.

(110 H.P. CLERGET.)

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes Span of Lower „ „	33′ 6″
Chord of Upper Main Planes Chord of Lower „ „	5′ 6″
Incidence of Upper Main Planes Incidence of Lower „ „	2° 10′
Dihedral	2° 23′
Gap	5′ 4¾″
Stagger	24″
Overall Length	25′ 3″
Height	10′ 3′
Droop of Ailerons	⅜″
Incidence of Tail Plane with Control Neutral	2°

Droop of Elevators with Tail Plane in mean position—Nil.

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SOPWITH 1½ STRUTTER.
(110 H.P. CLERGET.)

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Leading Edges of Main Planes are symmetrical about Centre line of Machine.

Examine the Centre Section (K. Rib) Bracing Wires for length and tautness, and see that the Split Pins are in position and that all Lock Nuts are tight.

Check the Dihedral.

Check the Stagger.

Check the Incidence.

See that the Interplane Struts are straight.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position.

Examine all Controls, Control Pulleys and Cables and see that they work freely, and that all Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is set correctly, and is square with Machine, and that all Tail Plane Bracing Wires are correct, both as to length and tautness, and that all Split Pins are in position and that all Lock Nuts are tight.

Examine Tail Plane Actuating Gear and see that it works freely.

Examine Rudder and Fin and see that they are set straight and square with Machine.

Measure the droop of the Ailerons and Elevators.

Examine Undercarriage and Tail Skid.

Examine Tank Mountings and connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories.

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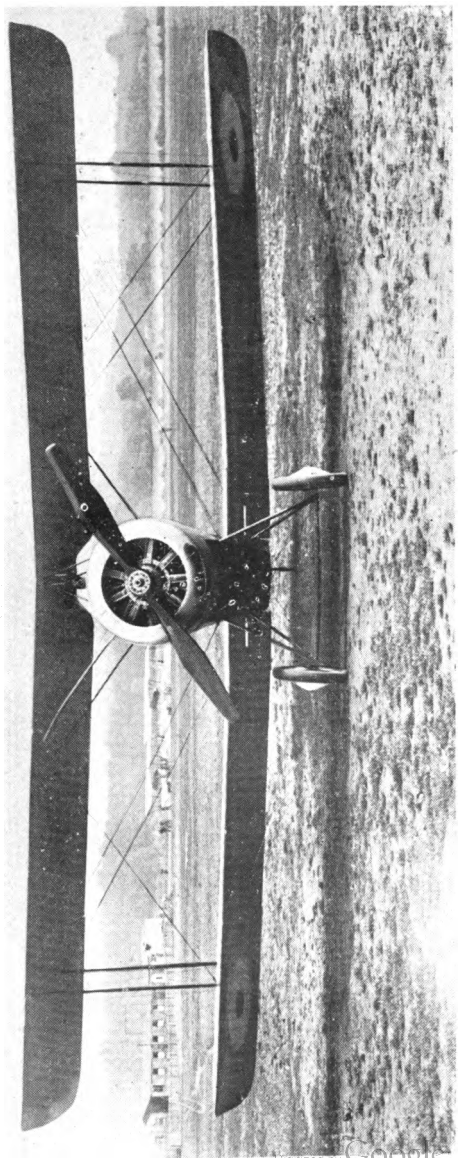
T.5. SOPWITH 1½ STRUTTER. (110 H.P. CLERGET.)

FIG. 1.



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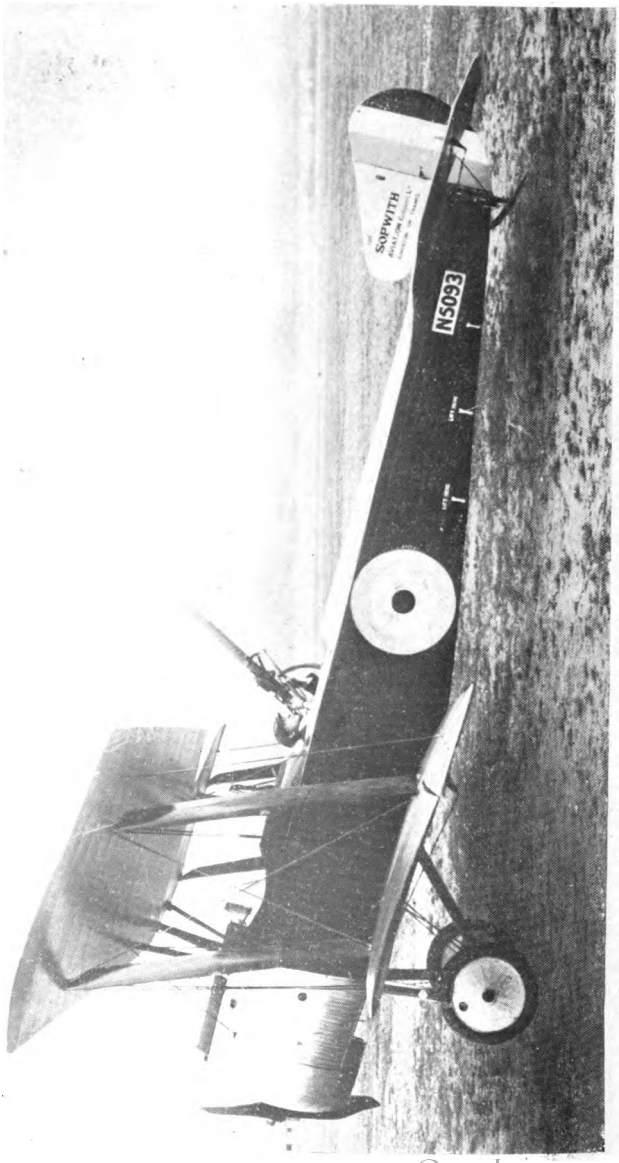
T.5. SOPWITH 1½ STRUTTER. (110 H.P. CLERGET.)

FIG. 2.



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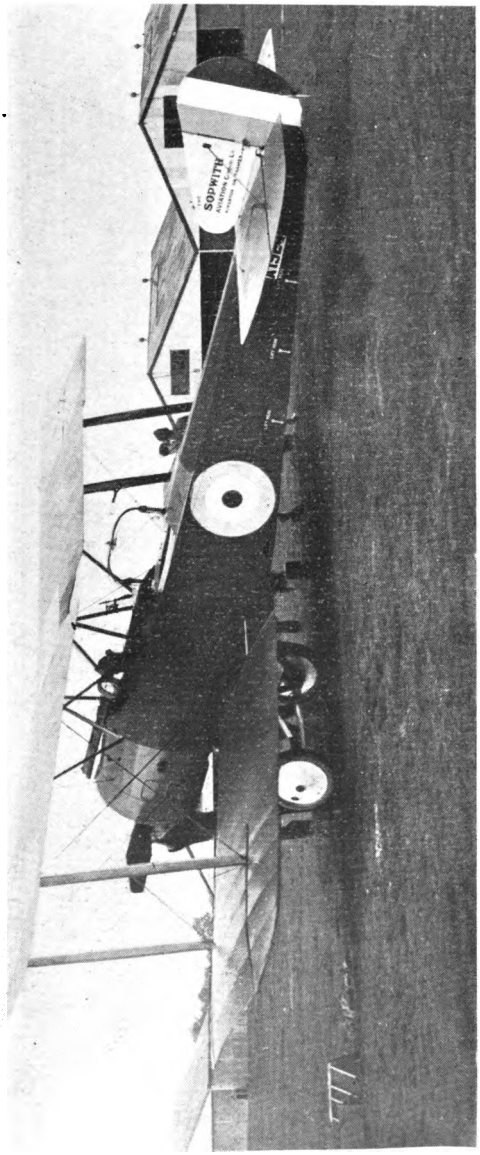
T.5. SOPWITH 1½ STRUTTER. (110 H.P. CLERGET.)
FIG. 3.



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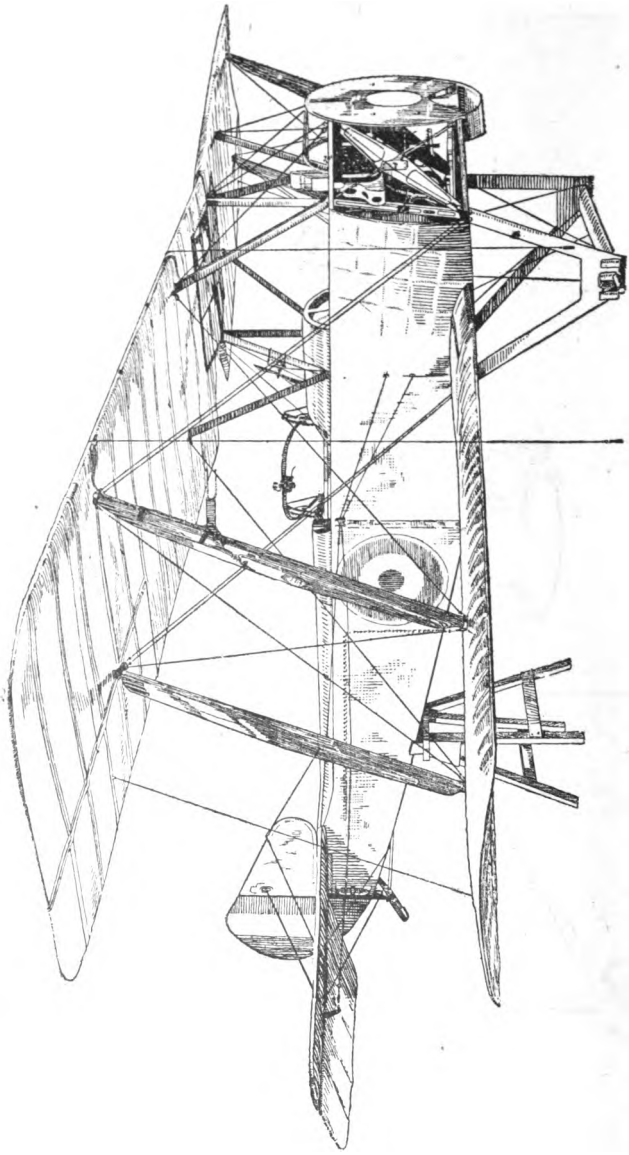
T.5. SOPWITH 1½ STRUTTER. (110 H.P. CLERGET.)
FIG. 6.



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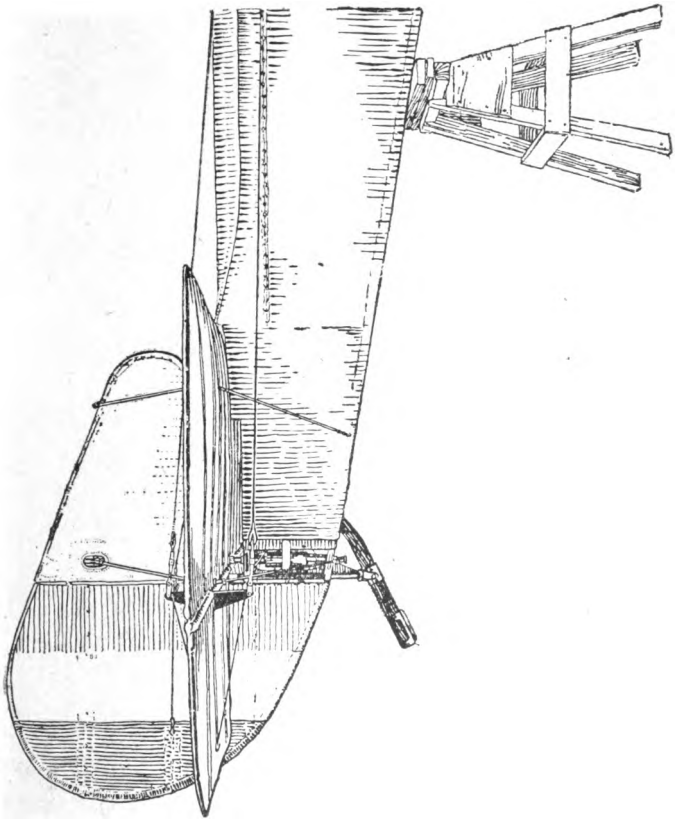
T.5. SOPWITH 1½ STRUTTER. (110 H.P. CLERGET.)
FIG. 7.



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SOPWITH 1½ STRUTTER.

(110 H.P. CLERGET.)

RIGGING DIAGRAMS.

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SOPWITH BIPLANE F.1.

(130 H.P. CLERGET.)

RIGGING NOTES.

Emanuel Fritz
Capt. Air Service.

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SOPWITH BIPLANE F. 1.

(130 H.P. CLERGET.)

MANUFACTURERS' ORDER OF ERECTION.

1. Fuselage assembled and trued up.
2. Tail Skid fitted and Cloche fitted.
3. Reinforcements of Top Longerons in Pilot's Cockpit fitted.
4. Fairing, Dashboard and Deck fitted.
5. Controls fitted in front of Fuselage.
6. Undercarriage fitted.
7. Machine erected in Flying Position with Main Planes and Empennage in skeleton and trued up.
8. Controls loosely connected.
9. Main Planes and Empennage dismantled.
10. Petrol Tanks fitted.
11. Fuselage covered and doped.
12. Engine Mounted and Engine Accessories and Controls fitted.
13. Gun Magazine and Shutes fitted.

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Sopwith Biplane F. 1 (130 H.P. Clerget).

14. Press Plate at bottom of first bay fitted.
15. Oil Tank fitted.
16. Gun and Actuating Gear fitted.
17. Centre Section fitted (after being covered and doped).
18. Wheels and Shock Absorbers fitted on Under-carriage.
19. Cowling fitted.
20. Main Planes and Empennage fitted (after being covered and doped).
21. Controls connected up and adjusted.

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SOPWITH BIPLANE F. 1.

(130 H.P. CLERGET.)

TRUING UP FUSELAGE (see Fig. 1).

The Side Struts are numbered from front to rear of Machine. Support the Fuselage on two trestles, one placed under the first bay and the other under the last bay.

Starting at No. 1 vertical Side Strut mark points on consecutive Vertical Side Struts $15\frac{1}{4}$", $15\frac{1}{4}$", $15\frac{1}{4}$", $15\frac{1}{4}$", $15\frac{1}{16}$", $13\frac{7}{32}$", $11\frac{5}{16}$", $9\frac{1}{2}$", $7\frac{5}{32}$", respectively below the *upper surface* of the Top Longerons. These marked points must be along the Thrust Line in Side elevation when Fuselage is trued up.

Lightly clamp a straightedge tranversely across No. 3 Side Struts, the marked points to be on the *upper edge*.

Lightly clamp small blocks of wood at all other marked points, the marks to be on the *upper edge* of the blocks.

Proceed to true up as follows :

Tension Internal Cross Bracing Wires until diagonals are equal in each section. Check by trammel.

Make Top Cross Bracing Wires equal in each bay and similarly make Bottom Cross Bracing Wires equal in each bay. Check by trammel.

Level the transverse straightedge by suitably packing up the front support.

Adjust the Side Bracing Wires on one side until any two consecutive marked points on Vertical Side Struts are in a horizontal line and all Struts are vertical.

Check the former by placing a straightedge across consecutive blocks and adjust until the straightedge is level and check the latter by plumbing each Strut.

Proceed similarly on the other side.

The Sternpost should be vertical viewed from any direction when the Fuselage is trued up.

TRUING UP UNDERCARRIAGE (see Fig. 2).

The Undercarriage is trued up by making Diagonal Bracing Wires equal in length. Check by trammel.

PLACING MACHINE IN FLYING POSITION.

Before truing up the Centre Section and fitting the Main Planes it is necessary to get the Machine in Flying Position.

NOTE.—The "Figs." refer to the Illustrations and *not* to the Rigging Diagrams.

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Sopwith Biplane F. 1 (130 H.P. Clerget).

To do this support the Machine by blocks placed under the Undercarriage Struts and on a trestle placed under the Tail. The Machine is in Flying Position when the Front Spar at the Bottom of the Fuselage to which the Front Spars of the Lower Main Planes are attached, is level transversely and when the Top Longerons in the Pilot's Cockpit are level longitudinally. Level longitudinally by raising or lowering Tail and transversely by packing blocks under the Undercarriage Struts.

TRUING UP THE CENTRE SECTION (See Figs. 2 and 3).

The Centre Section is symmetrical about the vertical centre line of Machine. True up by Centre Section Cross Bracing Wires and ensure that both Upper Wires are equal in length and also that both Lower Wires are equal in length.

The *Stagger* of the Centre Section is 18". This can be adjusted by the Stagger Wires *after* the Lower Main Planes have been fitted.

Check by dropping plumb lines from the Leading Edges of the Centre Section; the *fore* and *aft* horizontal distance of the Leading Edge of the Lower Main Planes should be 18" from the plumb lines.

ATTACHING THE MAIN PLANES.

Place the Lower Main Planes in position and insert the Securing Rod on each side from the *rear*.

Push the latter Rod well in and secure it to the *Ribs* at the Roots of the Main Planes by nuts and bolts, not forgetting to insert the *Split Pins*.

Loosely connect the Landing Wires.

Lift the Upper Main Planes in position, insert the Securing Rods from the *front* and after pushing the Rods well in, secure the front of the Rods to the Leading Edges of the Main Planes.

Loosely connect Flying and Incidence Wires.

TRUING UP MAIN PLANES.

Drop plumb lines from four points, two each side, on the Leading Edge of the Upper Main Planes. True up until—

(*a*) The plumb lines are in line viewed from the side.

(*b*) The Leading Edge of the Upper Main Planes is straight viewed from the front and in plan view, there being no *Dihedral* on the Upper Main Planes.

(*c*) The Leading Edge of the Lower Main Planes is symmetrical about centre line of Machine.

Check by taking measurements from Bottom Sockets of Front Outer Struts to Rudderpost and Propeller Boss. Corresponding measurements should be the same on both sides.

(*a*) The *Dihedral* of the Lower Main Planes is 5°. Check by Abney level and straightedge along the Front and Rear Spars.

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Sopwith Biplane F. 1. (130 H.P. Clerget).

(*e*) The *Stagger* is 18″ at *Centre Section* and $18\frac{5}{16}$″ at *Outer Struts*. Check by measuring the *fore* and *aft* horizontal distance from the Leading Edge of the Lower Main Planes to the plumb lines dropped from the Leading Edge of the Upper Main Planes.

(*f*) The *Incidence* is 2° throughout. Check by Abney level and straightedge, taking care to place the latter from Leading Edge to Trailing Edge at *Ribs*.

(*g*) There is no "*Wash In*" or "*Wash Out.*"

FIXING THE EMPENNAGE. (See Figs. 3 and 4).

Bolt the Tail Plane in position and connect the Tail Plane Bracing Wires.

True up the Tail Plane to be level transversely.

Check by spirit level along the Front Spar and along the Hinged Tube.

Check for Tail Plane being square with Machine by taking measurements from Bottom Sockets of Rear Outer Struts to lateral extremities of Rear Spar of Tail Plane.

These measurements should be the same on both sides.

The *Incidence* of the Tail Plane is $1\frac{1}{2}$°. Check by using a straightedge with two small blocks attached. These blocks should be of such dimensions that when one is on the Front Spar and the other on the Hinged Tube of the Tail Plane, the *upper edge* of the straightedge is parallel to the *fore* and *aft* centre line of the Tail Plane.

The *Incidence* can be measured by an Abney level over the straightedge with Machine in flying Position.

Bolt the Fin in Position.

Hinge the Rudder to the Sternpost and Fin, not forgetting to insert the Split Pins, similarly hinge the Elevators to the Rear Spar of Tail Plane.

NOTE.—The two Elevators should be rigidly connected, so that if the Elevator Control is damaged on one side the Elevators can be operated from the other side.

CONTROLS.

Connect up the Controls and adjust them so that

(*a*) With the Pilot's Control Stick central there is no *Droop* on the Ailerons.

(*b*) When the upper *front edge* of the tubular reinforcement on the Pilots Control Stick just beneath the handle is $9\frac{3}{4}$″ *horizontally in rear* of the Dashboard, the Elevators are in continuation of the Tail Plane.

(*c*) The Rudder and Tail Skid point directly *fore* and *aft* and are square with Machine when the Rudder Bar is square in Fuselage.

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SOPWITH BIPLANE F. 1.

(130 H.P. CLERGET.)

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes „ Lower „ „	28′ 0″
Chord of. Upper Main Planes „ Lower „ „	4′ 6″
Incidence of Upper Main Planes „ Lower „ „	2°
Gap at Fuselage	5′ 0″
Stagger at Centre Section	18″
„ Outer Struts	18 $\frac{5}{16}$″
Dihedral of Upper Main Planes	Nil
„ Lower „ „	5°
Overall Length	18′ 9″
Height	8′ 6′
Incidence of Tail Plane (Centre Line)	1½°
Droop of Ailerons	Nil

Elevators are in continuation of Tail Plane when Upper Front Edge of Tubular Reinforcement on Pilot's Control Stick, just beneath the handle is 9¾″ horizontally in rear of Dashboard.

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Sopwith Biplane F. 1 (130 H.P. Clerget).

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Leading Edges of the Main Planes are symmetrical, about centre line of Machine.

Examine the Bracing Wires for length and tautness in the Centre Section, and see that the Split Pins are in position, and that all Lock Nuts are tight.

Check the Dihedral of Lower Main Planes.

Check the Stagger.

Check the Incidence.

See that the Interplane Struts are straight.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position.

Examine all Controls, Control Pulleys and Cables, see that they work freely and that Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is set correctly and is square with Machine, and that all Tail Plane Bracing Wires are correct both as to tautness and length, and that all Split Pins are in position, and that all Lock Nuts are tight.

Examine Rudder and Fin and see that they are set straight and square with Machine.

Measure the Droop of the Ailerons and Elevators.

Examine Undercarriage and Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories.

Examine Cartridge Drums and see that they are secure and do not foul the Carburetter.

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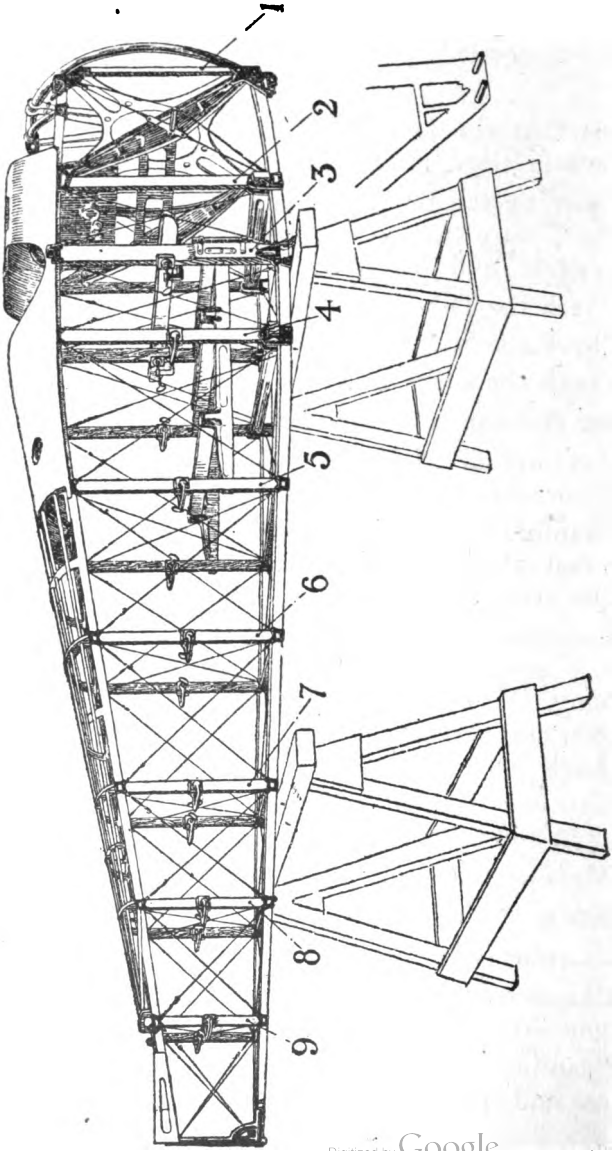
T.5. SOPWITH BIPLANE F.I (130 H.P. CLERGET).

FIG. 1.



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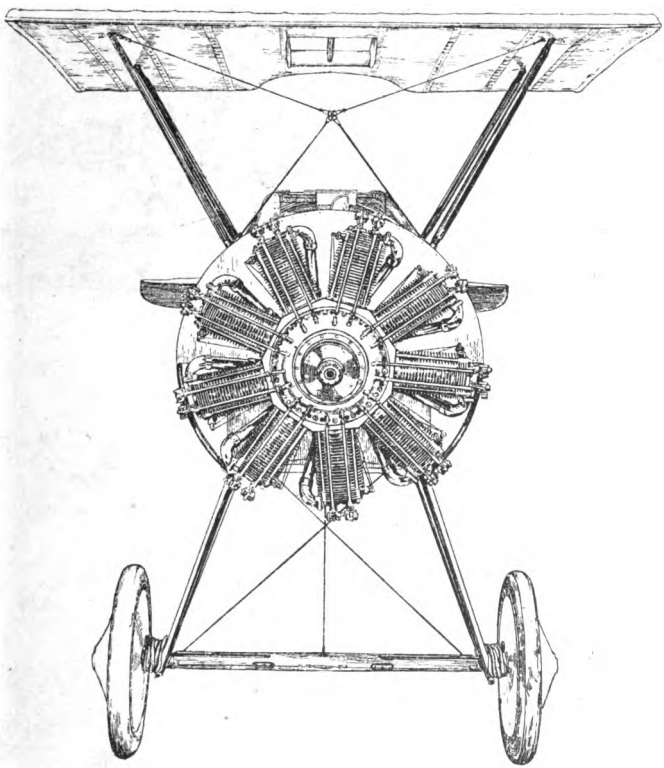
T.5. SOPWITH BIPLANE F.I (130 H.P. CLERGET).

FIG. 2.



NOTE.—This illustration shews the 150 H.P. A.R.I., which in some cases is fitted.

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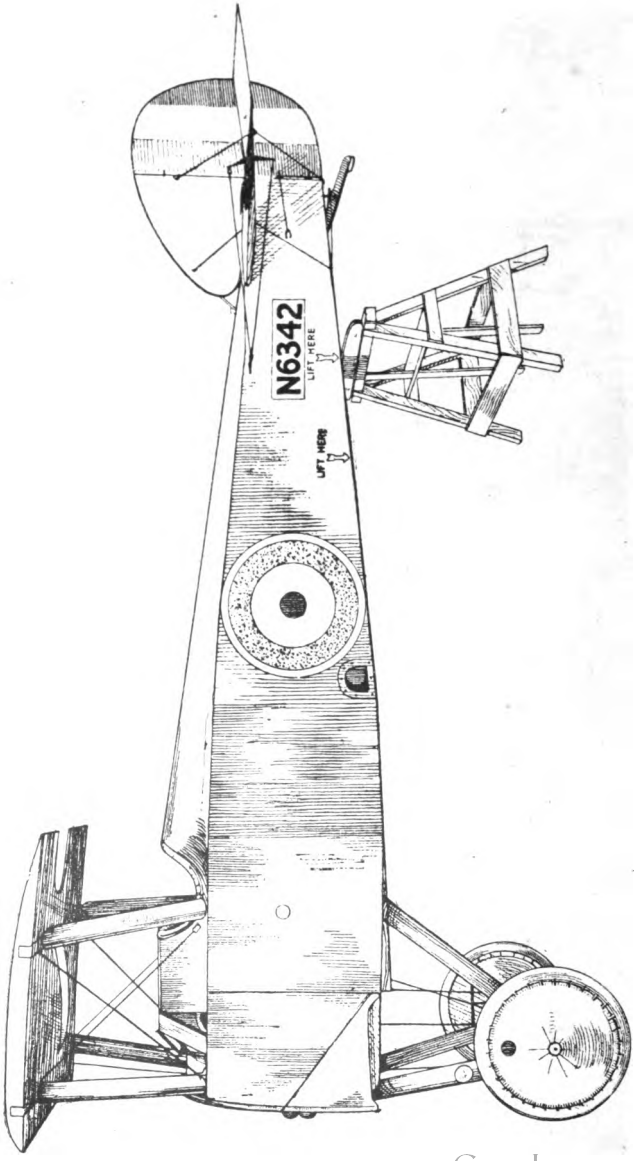
T.5. SOPWITH BIPLANE F.I (130 H.P. CLERGET).

FIG. 3.



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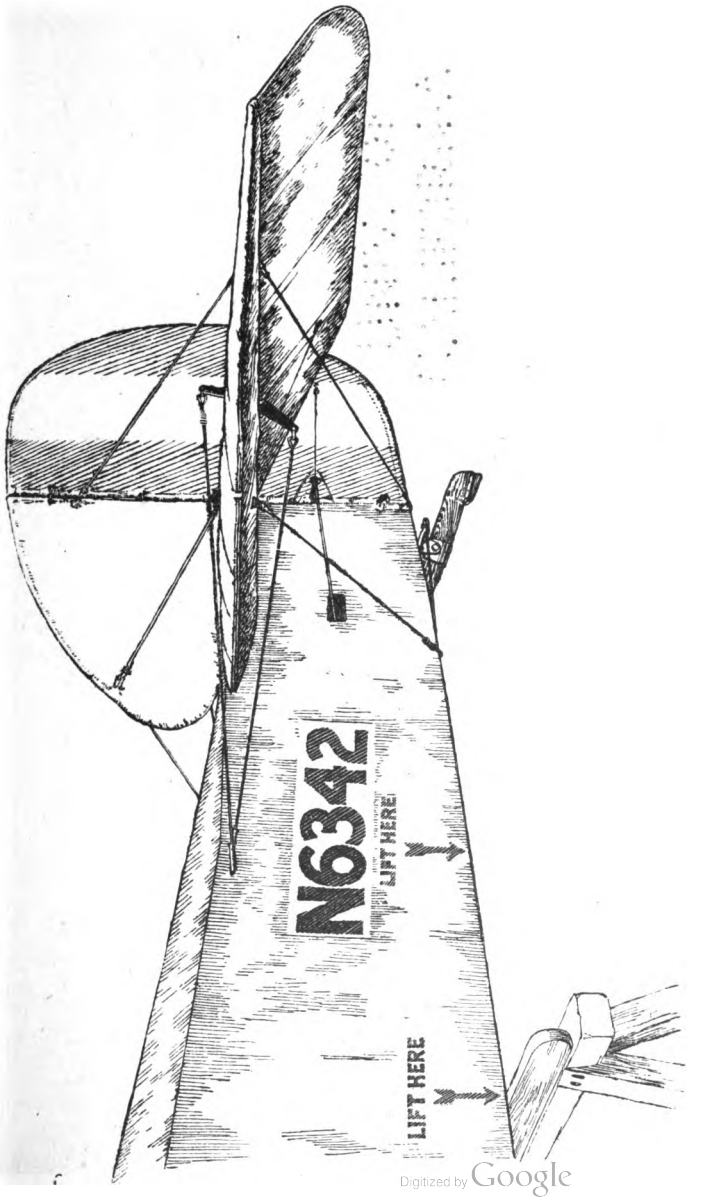
T.5. SOPWITH BIPLANE F.I (130 H.P. CLERGET).

FIG. 4.



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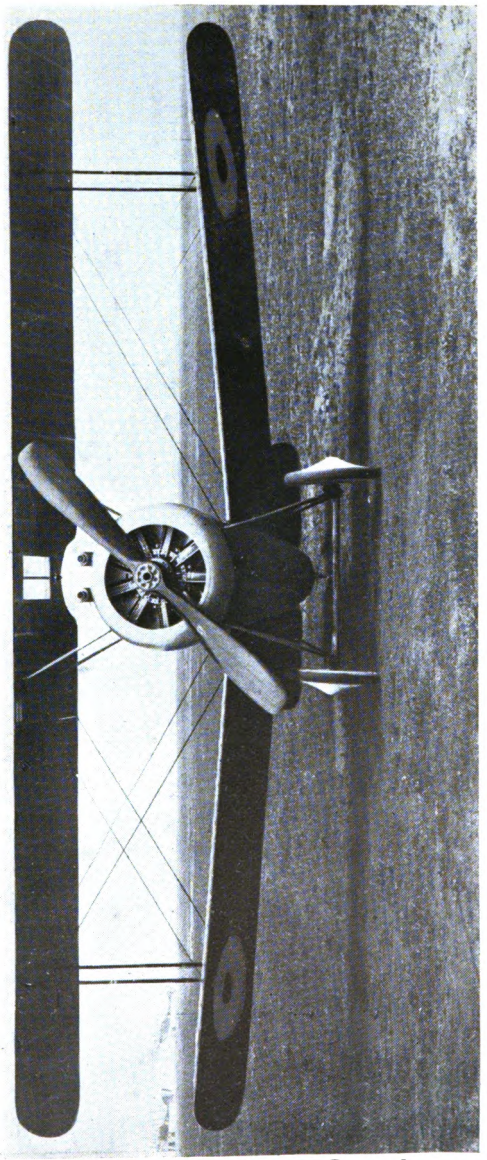
T.5. SOPWITH BIPLANE F.1 (130 H.P. CLERGET).
FIG. 5.



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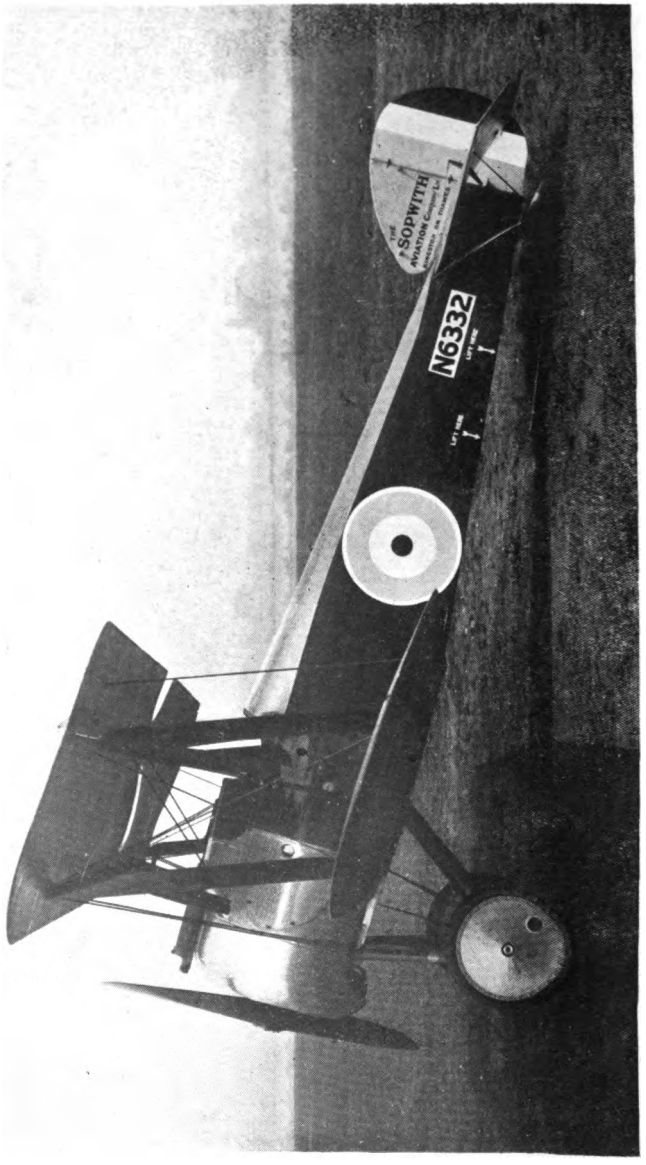
T.5. SOPWITH BIPLANE F.1 (130 H.P. CLERGET).
FIG. 6.



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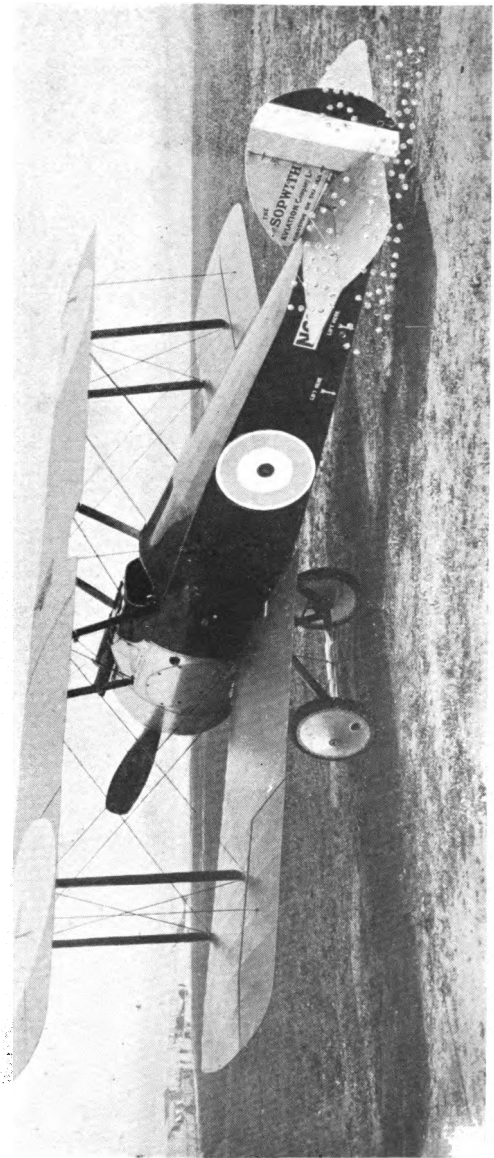
T.5. SOPWITH BIPLANE F.1 (130 H.P. CLERGET).
FIG. 7.



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SOPWITH BIPLANE F.1.

(130 H.P. CLERGET).

RIGGING DIAGRAMS.

T.5.

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SOPWITH BIPLANE. F.1.

130 HP. CLERGET.

FIG. 1.
SIDE ELEVATION

FIG. 2.
FRONT ELEVATION
(LESS MAIN PLANES)

Flying Position:

To get Machine in Flying Position level transversely across the lower Front Spar in Fuselage and longitudinally across the upper surface of the Top Longerons in the Pilot's Cockpit.

Truing up Fuselage:

The Fuselage is symmetrical in plan view and from Strut No.6 to Rudder Post in Side Elevation.

Mark points on Side Struts so that these points are on the Thrust Line in Side Elevation. (*for distances below the upper face of the Top Longerons see Table A Sheet 4.*)

Make Internal Cross Bracing Wires equal at each section. Check by Trammel.

Make Top Cross Bracing Wires equal in each Bay. Similarly make Bottom Cross Bracing Wires equal in each Bay. Check by Trammel. True up by Side Bracing Wires until all marked points on Side Struts are in line in Side Elevation levelling from marked point to marked point on adjacent Side Strut and checking each Side Strut for being Vertical.

Truing up Undercarriage:

True up until Cross Bracing Wires are equal. Check by Trammel.

Truing up Centre Section:

The Centre Section is symmetrical about the Vertical centre line of Machine. Adjust by Centre Section Cross Bracing Wires until Upper Wires are equal and Lower Wires are equal. Check by Trammel.

The Stagger of the Centre Section is 16. Check after fitting Lower Main Planes and adjust by Centre Section Stagger Wires.

4 Sheets
Sheet 1.

D

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SOPWITH BIPLANE. F.1.

130 HP. CLERGET.

Fig 3.
FRONT ELEVATION.

POSITION OF UPPER MAIN PLANE IN RELATION TO LOWER MAIN PLANE

Fig 4

MAIN PLANES

The leading Edge of Upper Main Planes is straight in plan view & viewed from front. The leading Edge of Lower Main Planes is symmetrical about centre line of Machine Drop Plumb lines on each side from the leading Edge of the Upper Main Planes. These lines must be in line viewed from the side.

Dihedral The Dihedral of the Lower Main Planes - 3° Check by Abney level and Straightedge along the Spars. There is no Dihedral on the Upper Main Planes.

Stagger The Stagger is 18" at Centre Section.

and 18½" at Outer Struts. Check by measuring the horizontal fore and aft distances between the Plumb lines and the leading Edge of Lower Main Planes.

Incidence The Incidence is 3° throughout Upper & Lower Main Planes. Check by Abney Bridge and Abney level from leading Edge to Trailing Edge at Ribs.

Ailerons There is no Dihedral on the Ailerons with Both Control Sticks Central,

4 Wheels
Dimple

SOPWITH BIPLANE. F.1.

130 HP. CLERGET.

FIG. 5.

GENERAL PLAN

Empennage
Tail Plane: The Tail Plane must be level transversely and have an Incidence of 1½° (angle between centre line of Tail Plane & Thrust Line)
Elevators: Elevators must be in continuation of Tail Plane when the front Upper Edge of the Pilots Control Stick is 9¾" from the Dashboard and neutral transversely.
Fin. This must point directly Fore and Aft and be square with Machine.
Rudder and Tail Skid: These must point directly Fore and Aft with Rudder Bar square in Fuselage.
Dashboard
9¾"
Pilots Control Stick
Sketch showing position of Pilots Control Stick when Elevators are in continuation of Tail Plane.
Rudder
Elevator
Elevator
Plane
Tail
Rudder Control 2-16 Cwt Cable
Skid Control 14 G Piano Wire
Fuselage
Rudder Control 2-16 Cwt Cable
Elevator Control 1-16 Cwt Cable
Port Lower Aileron
Port Upper Aileron
Port Lower Main Plane
Pilots Control Stick
Aileron Control Wire 1-15 Cwt Cable
Port Upper Main Plane
Aileron Balance Wire 1-16 Cwt. Cable
Starboard Lower Aileron
Starboard Upper Aileron
Starboard Lower Main Plane
Centre Section
Starboard Upper Main Plane
Engine Cowl
Skid Control 14 G Piano Wire

4 Sheets
Sheet 3.

D

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SOPWITH DOLPHIN 5 F. 1.

(200 H.P. HISPANO-SUIZA).

RIGGING NOTES.

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SOPWITH DOLPHIN 5.F.1.

[200 H.P. HISPANO-SUIZA.]

MANUFACTURERS' ORDER OF ERECTION.

1. Fuselage assembled and trued up; Front Engine Plate and Sternpost bolted up after truing up the Fuselage.
2. Undercarriage fitted.
3. Centre Section fitted and trued up with Fuselage in Flying Position.
4. Petrol Tanks fitted.
5. Decking and Fairing fitted.
6. Instrument Board fitted.
7. Engine mounted.
8. Gun Mount and Shutes fitted.
9. Oil Tank fitted.
10. Radiators fitted, but not fixed.
11. Oil, Petrol, Water, and Air Service connected up.
12. Controls fitted in front of Fuselage.
13. Main Planes and Empennage fitted in skeleton and Controls connected up and adjusted.
14. Main Planes and Empennage dismantled for covering and doping.
15. Sides of Fuselage under Centre Section covered and Radiators fixed.
16. Main Planes and Empennage refitted after covering and doping.
17. Engine Cowl fitted.

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SOPWITH DOLPHIN 5.F.1.

(200 H.P. HISPANO-SUIZA.)

TRUING UP THE FUSELAGE.

The Fuselage is symmetrical in plan view throughout, and in Flying Position all Side Struts are vertical.

To true up, support the Fuselage on two trestles, one placed between the Spars which form attachments for the Spars on the Lower Main Planes, and the other under the Tail.

Mark points on Side Struts 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. 11 at distances 2$\frac{5}{32}$in., 4$\frac{1}{2}$in., 7$\frac{3}{4}$in., 9$\frac{7}{8}$in., 11in., 11$\frac{1}{4}$in., 10$\frac{1}{2}$in., 9$\frac{7}{16}$in., 8$\frac{3}{4}$in., 8in., 7$\frac{1}{4}$in. respectively, along the centre lines of the Struts, below the top face of the Top Longerons.

Also mark a point on the Sternpost 6$\frac{1}{2}$in. below the top face of the ends of the Top Longerons.

These marked points will be along the Datum Line in side elevation with Fuselage true and in Flying Position.

Mark the mid points of all Cross Struts top and bottom. Pack up the supports so as to level the Engine Bearers and Spars at the bottom of the Fuselage as far as possible. By means of Side Bracing Wires in 2nd, 3rd, 4th, and 5th Bays, take out the wind between the two Spars, and check by spirit level.

The Engine Bearers should be level and remain level. Drop two plumb lines, one along each Side Strut at Rear Spar. Drop another plumb line along the Sternpost.

Before any truing up is attempted it is necessary to ensure that Strut Sockets are accurately spaced along the Longerons, and particularly that corresponding consecutive Sockets on both sides are equally spaced; also that all Struts are cut accurately to length.

Working from front to rear, adjust Internal Cross Bracing Wires, making corresponding diagonals equal at each section, and check by trammel all through.

Adjust Top Cross Bracing Wires, making corresponding diagonals equal in each bay, and check by trammel all through. A centre line stretched from the *axis* of the Rudderpost to the mid point of the Front Top Cross Strut should cut the mid points of all Top Cross Struts. Check by try square at each mid point. The base of try square should be along the Strut, and the marked point on one edge of the blade.

The top stretched centre line should *just touch the same edge* of the blade.

Proceed similarly for the Bottom Cross Bracing Wires, carefully tramelling each bay in turn.

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Sopwith Dolphin 5.F.1. (200 H.P. Hispano-Suiza).

Slacken the Side Bracing Wires on one side, and by means of the Side Bracing Wires on the other side true up until all marked points on Side Struts and the marked point on the Sternpost are in line in side elevation, *this Datum line to be level.*

Level from marked point to marked point on consecutive Struts, using a long straightedge across the marked points, and moving the straightedge from front to rear, and so lining up all marked points.

Proceed in an exactly similar manner on the other side. During the whole process of truing up the Fuselage it is important to be continually checking the Spars at the bottom of the Fuselage which form attachments for Spars of Lower Main Planes for being level, and the Side Struts at the Rear Spar for being vertical; also the Sternpost for being vertical. Check for there being no wind in the Fuselage by placing a straightedge across the Top Longerons at several points, and checking the straightedge for being level at each point.

NOTE.—(a) Tie Rods should be cut accurately to length; otherwise it will be impossible to get the Fuselage true.

(b) It is important in truing up the Fuselage not to overtighten the Bracing Wires and so prevent unnecessary compressive stresses being set up in the Struts and Longerons.

(c) On all Wires where Turnbuckles occur the threaded portion should be fully engaged inside the Barrels.

(d) All Bolts on Fuselage are burred over after truing up.

(e) Care should be taken with Lock Nuts on Tie Rods, as overtightening may fracture the Rods.

TRUING UP THE UNDERCARRIAGE.

The Undercarriage is symmetrical about the vertical centre line of Machine.

True up by Front Cross Bracing Wires, making corresponding diagonals equal, and check by trammel.

PLACING THE MACHINE IN FLYING POSITION.

Before truing up the Centre Section and attaching and truing up the Main Planes it is necessary to get the Machine in Flying Position.

To do this block the Machine up under the Undercarriage Struts and support the Tail on a trestle placed near the Sternpost.

The Machine is in Flying Position when the Engine Bearers are level longitudinally and Front and Rear Spars at bottom of Fuselage are level transversely.

Make transverse adjustments by packing blocks under the Undercarriage Struts, and make longitudinal adjustments by raising or lowering the Tail.

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Sopwith Dolphin 5.F.1. (200 H.P. Hispano-Suiza).

TRUING UP THE CENTRE SECTION.

The Centre Section Framework should be symmetrical about the vertical centre line of Machine.

Adjust by Rear Cross Bracing Wires and check by dropping a plumb line from the mid point of the Rear Spar Tube. This line should strike the mid point of the Top Cross Strut of the Fuselage immediately below it.

The Stagger of the Centre Section is 12in. to the *rear*. Check by dropping plumb lines from the vertical centre lines of the lateral extremities of the Front Spar Tube. The horizontal fore and aft distances between these plumb lines and the vertical centre lines of the lateral extremities of the Lower Front Spar of Fuselage should be 12in.

Adjust by Side Bracing Wires.

Centre Section Struts should be vertical viewed from the front.

ATTACHING THE MAIN PLANES.

Place the Lower Main Planes in position and insert the Securing Rods from the front, supporting the Wing Tips on trestles. Loosely connect the Landing Wires in the Inner Bays.

Fit the Interplane Struts on the Upper Main Planes, and by means of the Struts lift the Upper Main Planes into position, fitting the Struts into the Bottom Sockets on the Lower Main Planes, and insert the Securing Rods from the front. Loosely connect up all the remaining Interplane Wires.

TRUING UP THE MAIN PLANES.

The *Dihedral* is 2½deg.

Adjust by Front Landing Wires, working from the centre outwards, and check by Abney level and straightedge or Dihedral Board along the Front Spars.

The *Stagger* is 12in. backwards.*

This should be correct at the Centre Section. To ensure that it is constant throughout, place straightedges across the Leading Edges of the Main Planes. Adjust Incidence Wires until any two of these straightedges are in line.

Check for Main Planes being square with Machine by taking measurements from Top and Bottom Sockets of Front Outer Struts to Rudderpost and Front Drag Wiring Plates. Corresponding measurements should be the same on both sides.

The *Incidence* is 1¾deg. throughout for both Upper and Lower Main Planes. Check by Abney level and straightedge, placing the latter from Leading Edge to Trailing Edge at Ribs.

Make adjustments by Incidence Wires and Rear Landing and Flying Wires.

---

* In the first four Machines the back Stagger is 13in

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Sopwith Dolphin 5.F.1. (200 H.P. Hispano-Suiza.)

It is important throughout the process of truing up the Main Planes to check the Dihedral, Stagger, and Incidence to ensure that adjustments for one do not throw the others out.

After truing up the Main Planes connect up the Front Drag Wires.

FIXING THE EMPENNAGE.

Place the Tail Plane into position, passing the holes in the Clips on the Front Spar over the Eye Bolts, which are secured to the fittings on the Top Longerons.

Bolt down and Split Pin the Bolts.

Fit the Nut and Screw Tail Plane Adjustment between the Fitting on the Rear Spar Tube and the corresponding Fitting on the Sternpost.

Hinge the Elevators to the Tail Plane, and insert the Split Pins.

Fit the Fin in position and connect up the Tail Plane Bracing Wires.

True up the Tail Plane to be level transversely, and to be square with the Machine.

The Raf-Wires should be carefully tensioned up so that the Tail Plane is held firmly, any undue tension being avoided.

Check for transverse level by spirit level over the Front and Rear Spars, and check for being square with Machine by taking measurements from Bottom Sockets of Rear Outer Struts to lateral extremities of Rear Spar of Tail Plane. These measurements should be the same on both sides.

The *Incidence* of Tail Plane in normal position is zero. Any adjustments can be made after tests.

Hinge the Rudder to Fin and Sternpost, and insert the Split Pins.

The Fin should point directly fore and aft, and be square with Machine.

CONTROLS.

With Pilot's Control Stick central the Ailerons should be in direct continuation of the Main Planes.

With Pilot's Control Stick Central transversely and with centre of top of handle 8in. *horizontally in rear* of Dashboard, the Elevators should be in direct continuation of the Tail Plane.

With Rudder Bar square in Fuselage the Rudder and Tail Skid should point directly *fore* and *aft*, and be square with Machine.

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SOPWITH DOLPHIN 5.F.1.

(200 H.P. HISPANO-SUIZA.)

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes - -	approx. 32ft. 6in.
,, Lower ,, - - - - -	32ft. 6in.
Chord of Upper Main Planes - - - -	4ft. 6in.
,, Lower ,, - - - -	4ft. 6in.
Incidence of Upper Main Planes - - -	1¾deg.
,, Lower ,, - - -	1¾deg.
Stagger (Back) - - - - - -	12in.
Dihedral, Upper Main Planes - - -	2½deg.
,, Lower ,, - - - -	2½deg.
Overall Length - - - - -	approx. 22ft. 3in.
Height - - - - - -	approx. 8ft. 6in.
Droop of Ailerons (with Pilot's Control Stick central)	Nil.
Droop of Elevator (with Top of Handle of Pilot's Control Stick 8in. horizontally in rear of Dashboard)	Nil.

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SOPWITH DOLPHIN 5.F.1.

(200 H.P. HISPANO-SUIZA.)

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Leading Edges of the Main Planes are symmetrical about centre line of Machine.

Examine the Bracing Wires for length and tautness in the Centre Section, and see that the Split Pins are in position and that all Lock Nuts are tight.

Check the Dihedral.

Check the Stagger.

Check the Incidence.

See that the Interplane Struts are straight.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position.

Examine all Controls, Control Pulleys and Cables, and see that they work freely and that Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is set correctly, and is square with Machine, and that all Tail Plane Bracing Wires are correct both as to tautness and length, and that all Split Pins are in position and that all Lock Nuts are tight.

Examine Rudder and Fin and see that they are set straight and square with machine.

Check the setting of the Ailerons and Elevators.

Examine Undercarriage and Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls and Engine Accessories.

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T.5. SOPWITH DOLPHIN, 5.F.1.
(200 H.P. HISPANO-SUIZA.)
FIG. 1.

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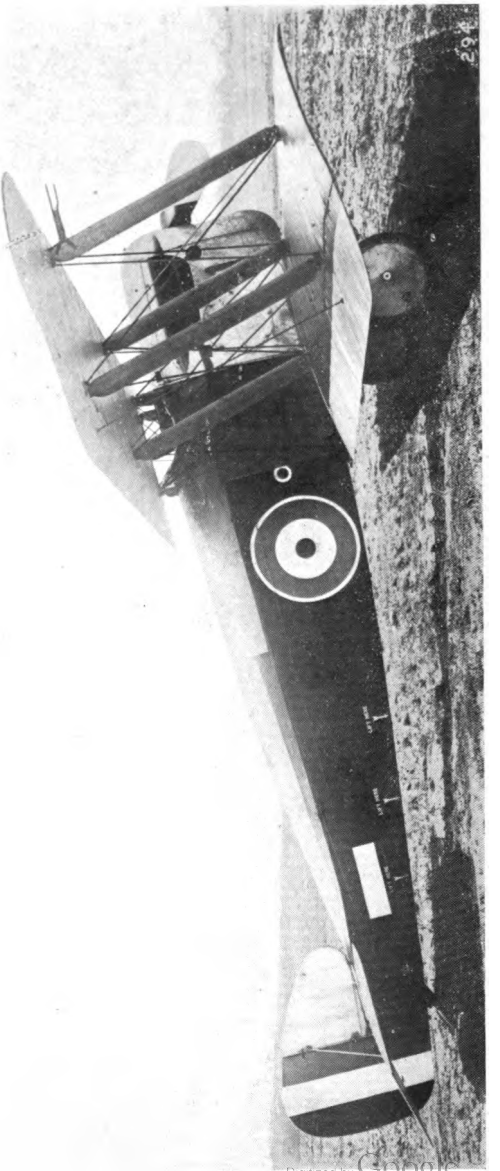
T.5. SOPWITH DOLPHIN, 5.F.1.
(200 H.P. HISPANO-SUIZA.)
FIG. 2.



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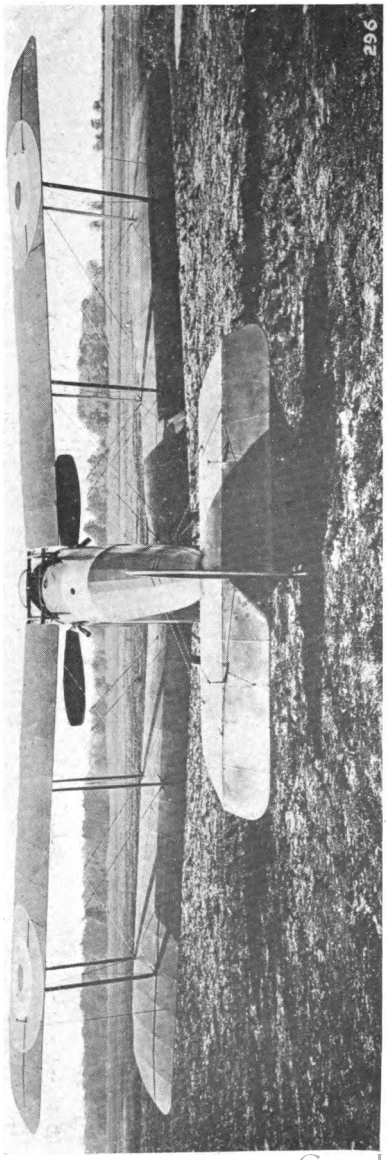
T.5. SOPWITH DOLPHIN, 5.F.1.
(200 H.P. HISPANO-SUIZA.)
FIG. 3.



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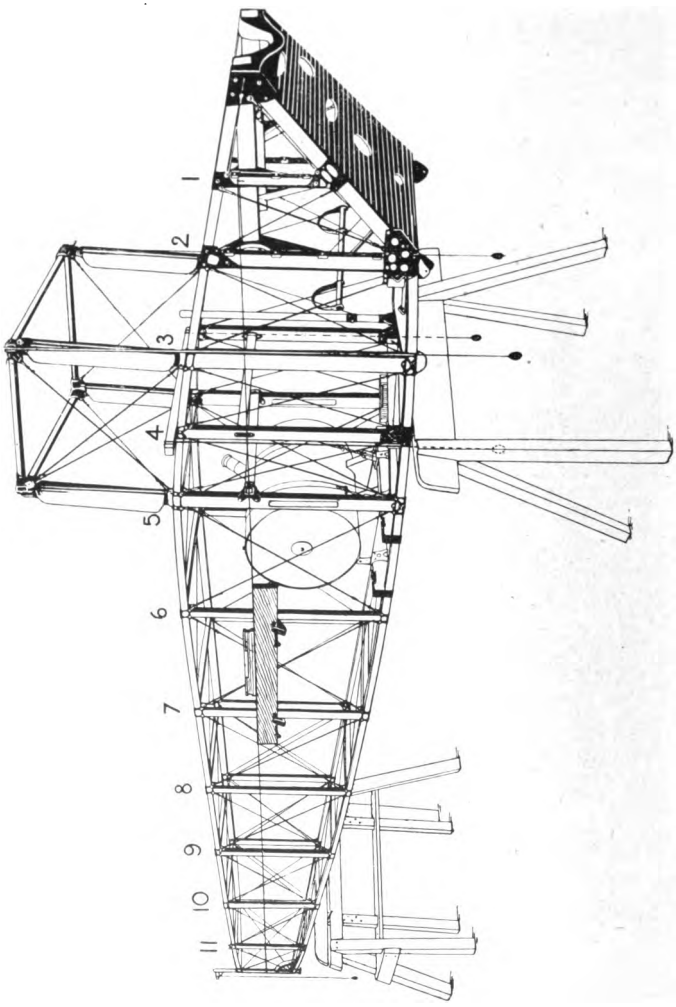
T.5. SOPWITH DOLPHIN, 5.F.1.
(200 H.P. HISPANO-SUIZA.)
FIG. 4.



TRUING UP FUSELAGE.

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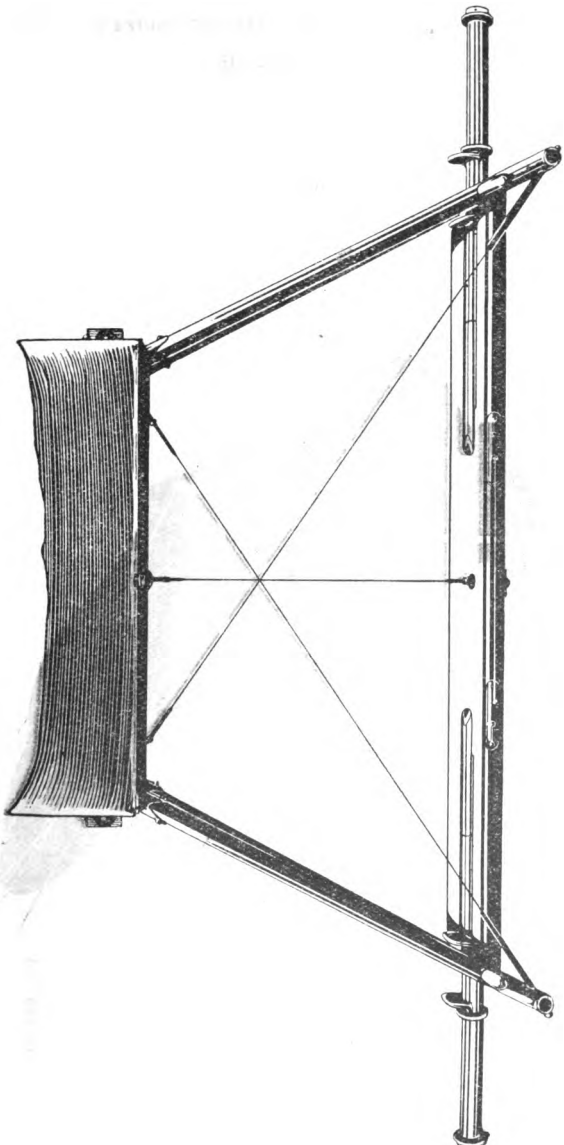
T.5. SOPWITH DOLPHIN, 5.F.1.
(200 H.P. Hispano-Suiza.)

Fig. 5.



UNDERCARRIAGE.

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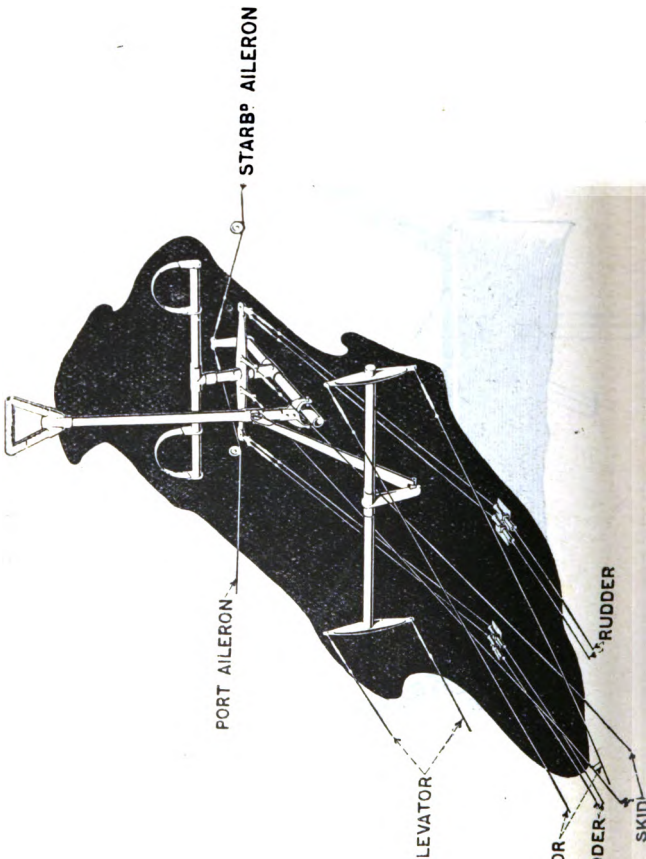
T.5. SOPWITH DOLPHIN, 5.F.1.

(200 H.P. HISPANO-SUIZA.)

FIG. 6.



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SOPWITH DOLPHIN 5.F.1.

(200 H.P. HISPANO-SUIZA.)

RIGGING DIAGRAMS.

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SOPWITH BIPLANE 2F.1.

(I) 130 H.P. Clerget.
(II) 150 H.P. B.R.1.

MANUFACTURERS' ORDER OF ERECTION.

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1. Fuselage assembled and trued up.
2. Tail Skid fitted and Cloche fitted.
3. Reinforcements of Top Longerons in Pilot's Cockpit fitted.
4. Fairing, Dashboard, and Deck fitted.
5. Controls fitted in front of Fuselage.
6. Undercarriage fitted.
7. Machine erected in Flying Position with Main Planes and Empennage in skeleton and trued up.
8. Controls connected and adjusted, but not fitted.
9. Main Planes and Empennage dismantled.
10. Petrol Tanks fitted.
11. Fuselage covered and doped.
12. Aluminium Plate on Front Engine Plate fitted.
13. Engine Mounted and Engine Accessories and Controls fitted.
14. Gun Magazine and Shutes fitted.
15. Undershield at bottom of first bay fitted.
16. Oil Tank fitted.
17. Gun and Actuating Gear fitted.
18. Oil and Petrol Pipes and Air Service connected up and tested.
19. Gun Mount for Lewis Gun fitted to Centre Section.
20. Centre Section fitted after being covered and doped.
21. Main Planes and Empennage fitted after being covered and doped.
22. Controls connected, adjusted, and locked.
23. Engine Cowl fitted and Gun Shutes fitted to Inspection Door.
24. Inspection Plates at bottom of Fuselage fitted.

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SOPWITH BIPLANE 2F.1.

(I) 130 H.P. CLERGET.

(II) 150 H.P. B.R.1.

RIGGING NOTES.

TRUING UP FUSELAGE.

The Fuselage is in two portions—(1) the Front Portion; (2) the Rear Portion. These are joined by Sockets and Turnbuckles.

The Side struts are numbered from front to rear of Machine.

Support the Fuselage on two trestles, one placed under the first bay, and the other under the last bay.

Starting at No. 1 vertical Side Strut mark points on consecutive vertical Side Struts $15\frac{1}{4}$", $15\frac{1}{4}$", $15\frac{1}{4}$", $15\frac{1}{4}$",, $15\frac{1}{16}$", $13\frac{7}{32}$", $11\frac{5}{16}$", $9\frac{1}{2}$" $7\frac{25}{32}$" respectively below the *upper surface* of the Top Longerons. Also mark a point on the Sternpost 6" below the top face of the Top Longerons. These marked points should be along the Thrust Line in side elevation when the Fuselage is trued up.

Lightly clamp a straightedge transversely across No. 3 Side Struts, the marked points to be on the *upper edge.*

Lightly clamp small blocks of wood at all other marked points, the marks to be on the *upper edge* of the blocks.

Proceed to true up as follows:—

Adjust Internal Cross Bracing Wires, making corresponding diagonals equal in each section, and check by trammel.

Adjust Top Cross Bracing Wires, making corresponding diagonals equal in each bay, and similarly adjust Bottom Cross Bracing Wires.

Level the transverse straightedge by suitably packing up the front support.

Adjust the Side Bracing Wires on one side until any two consecutive marked points on vertical Side Struts on that side are in a horizontal line, and all Struts are vertical.

Check the former by placing the straightedge across consecutive blocks, and adjust until the straightedge is level, and check the latter by plumbing each Strut.

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SOPWITH BIPLANE 2F.1, *continued*--

Proceed similarly on the other side.

The Sternpost should be vertical viewed from any direction when the Fuselage is trued up.

TRUING UP THE UNDERCARRIAGE.

The Undercarriage is trued up by adjusting Diagonal Bracing Wires until corresponding diagonals are equal. Check by trammel.

PLACING MACHINE IN FLYING POSITION.

Before truing up the Centre Section and fitting the Main Planes it is necessary to get the Machine in Flying Position.

To do this support the Machine by blocks placed under the Undercarriage Struts and on a trestle placed under the Tail. The Machine is in Flying Position when the Front Spar at the bottom of the Fuselage to which the Front Spars of the Lower Main Planes are attached is level transversely, and when the Top Longerons in the Pilot's Cockpit are level longitudinally. Level longitudinally by raising or lowering Tail, and transversely by packing blocks under the Undercarriage Struts.

TRUING UP THE CENTRE SECTION.

The Upper Centre Section Plane is symmetrical about the vertical centre line of Machine. True up by Centre Section Cross Bracing Wires, and ensure that both Upper Wires are equal in length, and also that both Lower Wires are equal in length.

The *Stagger* of the Centre Section is 18". This can be adjusted by the Side Bracing Wires *after* the Lower Main Planes have been fitted.

Check by dropping plumb lines from the Leading Edges of the Upper Centre Section Plane; the horizontal *fore* and *aft* distances of the Leading Edge of the Lower Main Planes should be 18" from the plumb lines.

ATTACHING THE MAIN PLANES.

Place the Lower Main Planes in position and insert the Securing Rod on each side from the *rear.*

Push the Rod well in and secure it to the *Ribs* at the Roots of the Main Planes by nuts and bolts, not forgetting to insert the *Split Pins.*

Loosely connect the Landing Wires.

Lift the Upper Main Planes in position, insert the Securing Rods from the *front,* and after pushing the *Rods* well in, secure the front ends of the Rods to the Leading Edges of the Main Planes.

Loosely connect Flying and Incidence Wires.

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SOPWITH BIPLANE 2F.1, *continued*—

TRUING UP MAIN PLANES.

Drop plumb lines from four points, two each side, on the Leading Edge of the Upper Main Planes.

There being no Dihedral on the Upper Main Planes, these should be level, and the Leading Edge straight in plan view and when looked at from the front.

The *Dihedral* of the Lower Main Planes is 5½°. Adjust by Front Landing Wires and check by Abney level and straightedge or spirit level and Dihedral Board along the Front Spars.

In truing up for Dihedral of Lower Main Planes it is necessary to ensure that the Upper Main Planes are not distorted.

The four plumb lines dropped from the Leading Edge of Upper Main Planes should be in line viewed from the side. This will ensure that the Leading Edge of Upper Main Planes is straight in plan view.

The *Stagger* should be 18" at the Centre Section, and 18⅛" at the Outer Struts. Adjust by Incidence Wires and check by measuring the horizontal *fore* and *aft* distances between the Leading Edge of the Lower Main Planes and the plumb lines dropped from the Leading Edge of Upper Main Planes.

Check for Main Planes being square with Machine by taking measurements from top and bottom sockets of Front Outer Struts to centre of Propeller Boss, and axis of Rudder Post. Corresponding measurements should be the same on both sides.

The *Incidence* should be 2° throughout for both Upper and Lower Main Planes.

Check by spirit level and Incidence Board or by Abney level and straightedge, placing the latter from Leading Edge to Trailing Edge at Ribs.

There is no "*Wash In*" or "*Wash Out.*"

It is important throughout the process of truing up the Main Planes to check the Dihedral, Stagger, and Incidence combined to ensure that adjustments for one do not throw the other out.

FIXING THE EMPENNAGE.

Place the Tail Plane in position and bolt the Front Spar to the Clips on Top Longerons, and Split Pin the Bolts.

Fit the Nut and Screw Tail Plane Adjustment between the Fitting on the Rear Spar Tube, and the corresponding Fitting on the Sternpost, not forgetting to lock the Nut to the Eyebolt provided with wire.

Hinge the Elevators to the Tail Plane, and insert the Split Pins.

Fit and bolt the Fin in position and connect up the Tail Plane Bracing Wires.

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SOPWITH BIPLANE 2F.1, *continued*—

True up the Tail Plane to be level transversely, and to be square with the Machine.

The Raf-Wires should be carefully tensioned up so that the Tail Plane is held firmly, any undue tension being avoided.

Check for transverse level by spirit level over the Front and Rear Spars, and check for being square with Machine by taking measurements from tops of Side Struts 7 to lateral extremities of Rear Spar of Tail Plane. These measurements should be the same on both sides.

The *Incidence* of centre line of Tail Plane in normal position is 1½°; in this position the distance from top of Longerons to under-surface of Rear Spar Tube should be 1 1/8". Any adjustments can be made after tests.

Hinge the Rudder to Fin and Sternpost, and insert the Split Pins.

The Fin should point directly *fore* and *aft*, and be square with Machine.

CONTROLS.

With Pilot's Control Stick central, the Ailerons should be in direct continuation of the Main Planes.

With Pilot's Control Stick central transversely and with centre of top of handle 10½" *horizontally* in rear of Dashboard, the Elevators should be in direct continuation of the Tail Plane.

With Rudder Bar square in Fuselage, the Rudder and Tail Skid should point directly *fore* and *aft*, and be square with Machine.

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SOPWITH BIPLANE 2F.1.

(I) 130 H.P. CLERGET.
(II) 150 H.P. B.R.1.

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	26′ 11″
Span of Lower Main Planes	26′ 11″
Chord of Upper Main Planes	4′ 6″
Chord of Lower Main Planes	4′ 6″
Incidence of Upper Main Planes	2°
Incidence of Lower Main Planes	2°
Gap at Fuselage	4′ 11 1/16″
Gap at Outer Struts	4′ 2 13/16″
Stagger at Centre Section	18″
Stagger at Outer Struts	18 5/16″
Dihedral of Upper Main Planes	Nil
Dihedral of Lower Main Planes	5½°
Over-all Length	18′ 9″
Height	8′ 10″
Wheel Track	4′ 5 1/8″
Incidence of Tail Plane (Centre Line)	1½°
Droop of Ailerons	Nil

Elevators are in continuation of Tail Plane when Top of Pilot's Control Stick is 10½° horizontally in rear of Dashboard.

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SOPWITH BIPLANE 2F.1.

(I) 130 H.P. CLERGET.

(II) 150 H.P. B.R.1.

POINTS TO OBSERVE WHEN OVERHAULING.

See that Turnbuckles at Joint of Fuselage are locked.

See that the Leading Edges of the Main Planes are symmetrical about centre line of Machine.

Examine the Bracing Wires for length and tautness in the Centre Section, and see that the Split Pins are in position, and that all Lock Nuts are tight.

Check the Dihedral of Lower Main Planes.

Check the Stagger.

Check the Incidence.

See that the Interplane Struts are straight.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position.

Examine all Controls, Control Pulleys and Cables, see that they work freely, and that Turnbuckles on Cables are locked, and see that the Split Pin is open in the Quick Release Gear.

Examine Tail Plane and see that it is set correctly and is square with Machine, and that all Tail Plane Bracing Wires are correct both as to tautness and length, and that all Split Pins are in position, and that all Lock Nuts are tight.

Examine Rudder and Fin, and see that they are set straight and square with Machine.

Check the Setting of the Ailerons and Elevators.

Examine Undercarriage and Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories.

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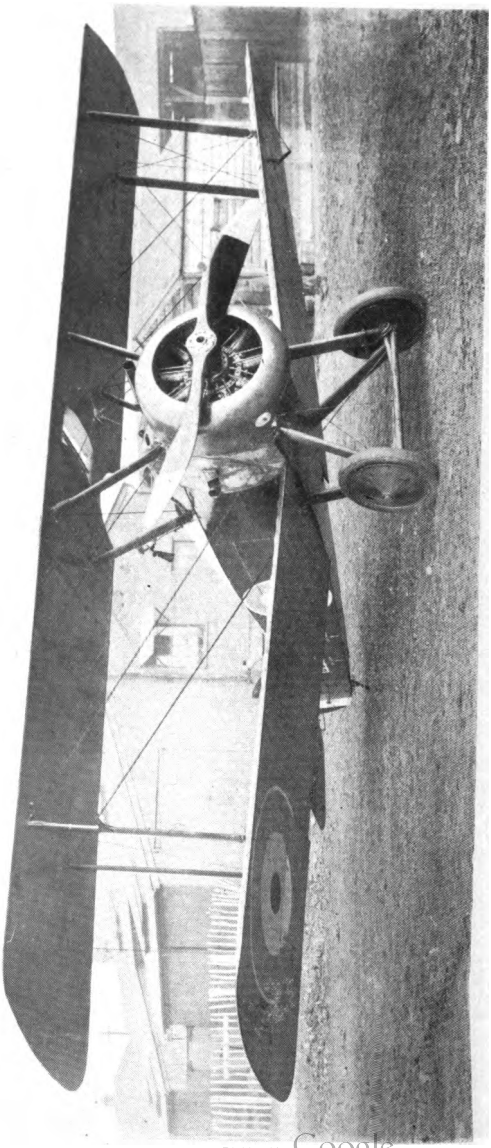
T.5. SOPWITH BIPLANE, 2.F.1.
(130 H.P. CLERGET).
FIG. 1.



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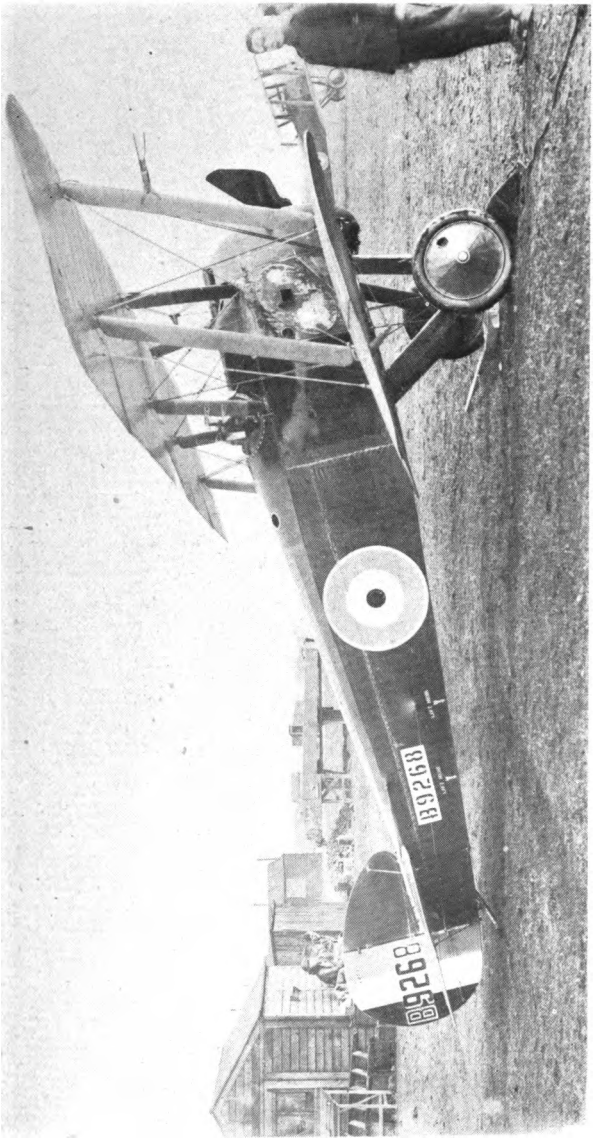
T.5. SOPWITH BIPLANE 2.F.1.
(130 H.P. CLERGET). FIG. 2.



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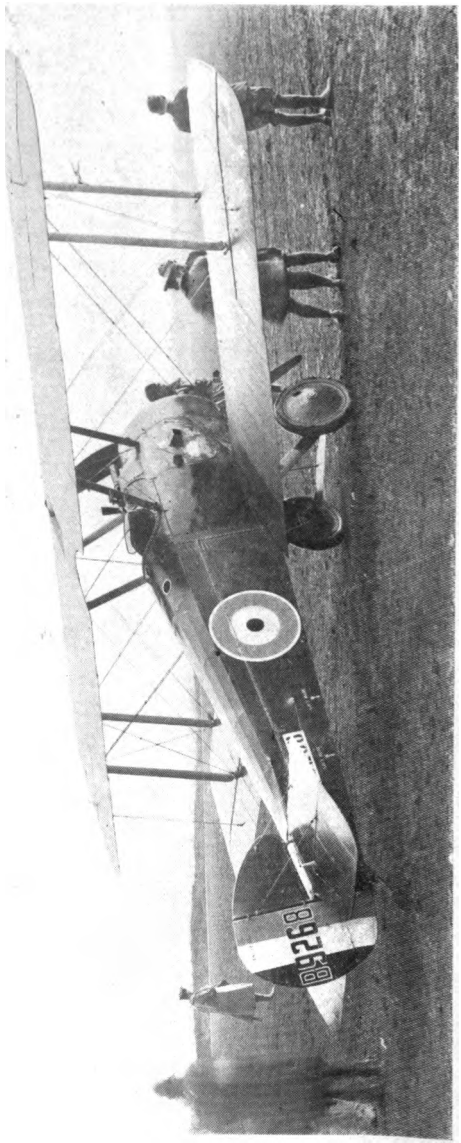
T.5. SOPWITH BIPLANE 2.F.1.
(130 H.P. CLERGET).
FIG. 3.



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SOPWITH BIPLANE 2.F.1.

(i) 130 H.P. CLERGET.

(ii) 150 H.P. B.R.1.

RIGGING DIAGRAMS.

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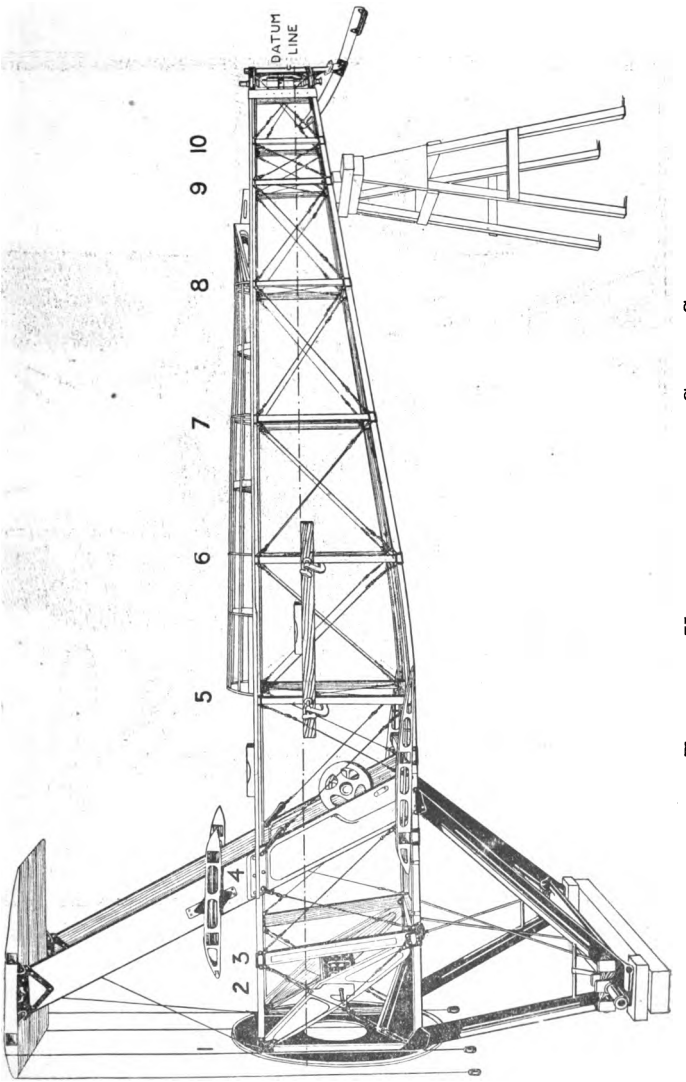
T.5. SOPWITH TRIPLANE (Single Seater). (110 H.P. and 130 H.P. Clerget.)

Fig. 5.



Truing up Undercarriage and Centre Section.

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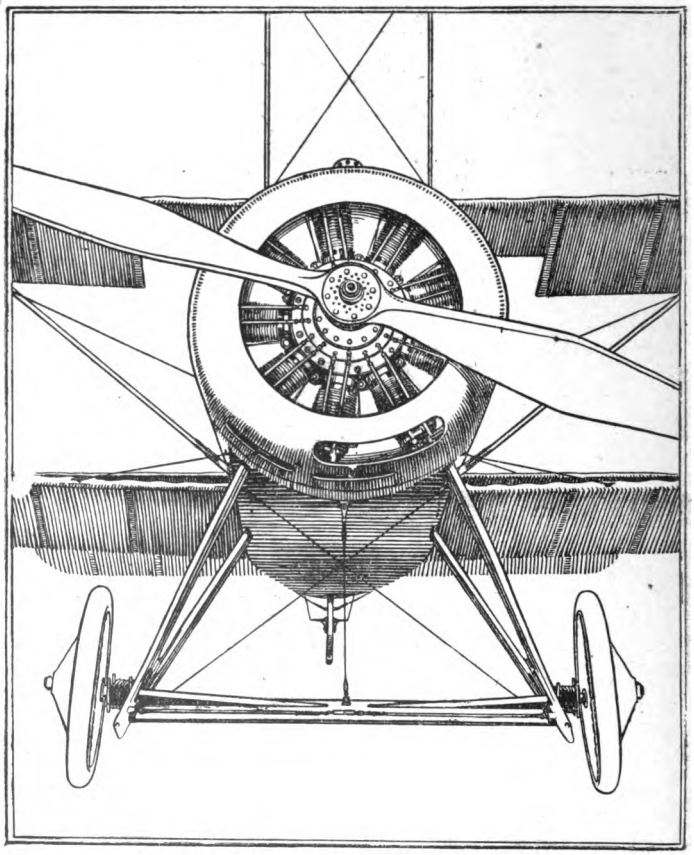
T.5. SOPWITH TRIPLANE (Single Seater).
(130 H.P. Clerget.)
Fig. 6.



Undercarriage.

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SOPWITH TRIPLANE (SINGLE-SEATER).

(110 H.P. & 130 H.P. CLERGET.)

RIGGING NOTES.

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SOPWITH TRIPLANE (SINGLE-SEATER). (110 H.P. & 130 H.P. CLERGET.)

MANUFACTURERS' ORDER OF ERECTION.

1. Fuselage assembled and trued up.
2. Tail Skid fitted and Cloche fitted.
3. Fairing, Dashboard and Deck fitted.
4. Controls fitted in front of Fuselage.
5. Undercarriage fitted.
6. Machine erected in Flying Position with Main Planes and Empennage in Skeleton and trued up.
7. Controls loosely connected.
8. Main Planes and Empennage dismantled.
9. Petrol Tanks fitted.
10. Engine Mounted and Engine Accessories and Controls fitted.
11. Gun Magazine and Chutes fitted.
12. Oil Tank fitted.
13. Gun and Actuating Gear fitted.
14. Centre Section fitted (after being covered and doped).
15. Wheels and Shock Absorbers fitted on Undercarriage.
16. Cowling fitted.
17. Main Planes and Empennage fitted (after being covered and doped).
18. Fuselage covered and doped.
19. Controls connected up and adjusted.

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SOPWITH TRIPLANE (SINGLE-SEATER).

(110 H.P. & 130 H.P. CLERGET.)

TRUING UP FUSELAGE.

The Fuselage is symmetrical in plan view throughout, and in Flying Position all Side Struts are vertical. The inner interplane Struts form part of the Fuselage. The side struts are numbered from front to rear, No. 4 being also the Inner Interplane Struts. To true up, support the Fuselage on two trestles, one placed between Side Struts Nos. 3 and 4, and the other under the Tail.

Mark points on all Side Struts and on the Sternpost 9″ vertically below the top face of the Top Longerons, and mark the middle points of all Top and Bottom Cross Struts.

The marked points on the Side Struts will be along the Datum line in side elevation with Fuselage true and in Flying Position. True up the Fuselage supports so as to level the Top Longerons as far as possible. By means of side Bracing Wires in bays adjacent to Inner Interplane Struts adjust until the Spars are level transversely. Check by straightedge and spirit level. The Top Longerons should be level and remain level. Drop a plumb line along the Sternpost. Before any truing up is attempted it is necessary to ensure that Strut Sockets are accurately spaced along the Longerons, and particularly that corresponding consecutive Sockets on both sides are equally spaced; also that all Struts are cut accurately to length.

Working from Front to Rear, adjust Internal Cross Bracing Wires, making corresponding diagonals equal at each section, and check by trammel all through.

Stretch a line from the mid point of the Front Top Cross Strut to the Sternpost. Adjust Top Cross Bracing Wires until the mid points of all Top Cross Struts are in line with the top stretched centre line.

Check by try-square at each mid point. The base of try-square should be along the Strut, and the marked point on one edge of the blade. The top stretched centre line should just touch the same edge of the blade.

Adjust Bottom Cross Bracing Wires until a plumb line dropped from the mid point of a Top Cross Strut strikes the mid point of the corresponding Bottom Cross Strut.

Slacken the Side Bracing Wires on one side, and by means of the Side Bracing Wires on the other side true up until all marked points on Side Struts 5, 6, 7, 8, 9, and the marked point on the Sternpost are in line in Side Elevation.

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Sopwith Triplane (110 H.P. & 130 H.P. Clerget) [Single Seater].

Level from marked point to marked point on consecutive Side Struts, using a long straightedge across the marked points and moving the straightedge from front to rear.

Proceed in a similar manner on the other side. During the whole process of truing up the Fuselage it is important to check continually for the Top Longerons being level, and the front engine plate and sternpost for being vertical.

The Fuselage should be checked for twist at all stages of truing. This can be done by putting two straightedges across the Top Longerons, one at the front, and the other at different points along the Fuselage. If there is no twist, the rear straightedge will always be in line with the front straightedge.

NOTE:—

(*a*) Tie rods should be cut accurately to length, otherwise it will be impossible to get the Fuselage true.

(*b*) It is important in truing up the Fuselage not to overtighten the Bracing Wires and so prevent unnecessary stresses being set up in the Struts and Longerons.

(*c*) On all Wires where Turnbuckles occur the threaded portion should be fully engaged inside the Barrels, and the Turnbuckles locked by wire.

(*d*) Care should be taken with Lock Nuts on Tie Rods, as overtightening may fracture the Rods.

TRUING UP THE UNDERCARRIAGE.

The Undercarriage is symmetrical about the vertical centre line of machine.

True up by adjusting Front Cross Bracing Wires, making corresponding diagonals equal, and check by trammel.

PLACING MACHINE IN FLYING POSITION.

Before truing up the Centre Section and attaching and truing up the Main Planes, it is necessary to get the Machine in Flying Position. To do this, block up the Machine under the Undercarriage struts and support the Tail on a trestle placed near the Sternpost.*

The Machine is in Flying Position when the Top Longerons are level longitudinally, the Front and Rear Spars at bottom of Fuselage are level transversely; and the Datum Line along the Side Struts is horizontal.

Make transverse adjustments by packing blocks under the Undercarriage Struts and make longitudinal adjustments by raising or lowering the Tail.

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* If the Engine is in position it is advisable to hang a weight of about 20lbs. on the tail of the Fuselage.

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Sopwith Triplane (110 H.P. & 130 H.P. Clerget) [Single Seater].

TRUING UP THE CENTRE SECTION.

The Centre Section should be symmetrical about the vertical centre line of Machine. Adjust by Cross Bracing Wires, making corresponding diagonals equal and check by trammel. Also check by dropping two plumb lines, one each side of the Centre Section, so that they fall in line with the front Engine Plate Struts viewed from the side. These plumb lines should be equidistant from the Engine Plate Struts.

The total Stagger of the Top Centre Section should be 36". Check by dropping plumb lines from the Leading Edge of the Top Centre Section so as to clear the Fuselage Longerons. The horizontal fore and aft distances between these plumb lines and the Leading Edges of the Bottom Box Ribs should be 36". When viewed from the front, the Inner Interplane Struts should be vertical.

ATTACHING THE MAIN PLANES.

Place the lower Main Planes in position and insert the Securing Rods from the front, supporting the Wing Tips on trestles.

Loosely connect the Landing Wires.

Fit the Outer Interplane Struts on the Intermediate Main Planes, and by means of the Struts lift the Intermediate Main Planes into position, fitting the Struts into the Bottom Sockets on the Lower Main Planes, and insert the securing Rods from the front.

Loosely connect up all the drag and anti-drag Wires.

The Top Plane is fixed with Tie Rods in Centre Section and with two Bolts to the top of the Outer Interplane Strut fitting.

Place the Top Main Plane in position and connect up to Interplane Struts and Centre Section. Connect up all remaining Interplane Wires.

TRUING UP THE MAIN PLANES.

The *Dihedral* of all Main Planes is $2\frac{1}{2}°$.

Adjust by Landing Wires, and check by Abney Level and Straightedge, or Dihedral Board and Spirit Level, along the Front Spars of the Upper Main Planes.

The *Stagger* from Upper Main Plane to Lower Main Plane is 36", being 18" between Upper and Intermediate and Intermediate and Lower Main Planes respectively.

This should be correct at the Centre Section. To ensure that it is constant throughout, place straightedges across the Leading Edges of the Main Planes Adjust Drag and Anti-Drag Wires until any two of these straightedges are in line.

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Sopwith Triplane (110 H.P. & 130 H.P. Clerget) [Single Seater].

Check for Main Planes being square with Machine by taking measurements from Top and Bottom Sockets of Outer Interplane Struts to Rudderpost and Front Drag Wiring Plates. Corresponding measurements should be the same on both sides.

The *Incidence* is 2° for all Main Planes. Check by Abney Level and Straightedge, placing the latter along the chord of a rib.

This can only be adjusted if the fittings on Interplane Struts have not been drilled.

It is important throughout the process of truing the Main Planes to check the Dihedral, Stagger and Incidence to ensure that adjustments for one do not throw the others out.

FIXING THE EMPENNAGE.

Place the Tail Plane into position, passing the holes in the Clips on the Front Spar over the Eye Bolts, which are secured to the fittings on the Top Longerons.

Bolt down and Split Pin the Bolts.

Fit the Nut and Screw Tail Plane Adjustment between the Fitting on the Rear Spar Tube, and the corresponding Fitting on the sternpost.

Hinge the Elevators to the Tail Plane, and insert the Split Pins.

Fit the Fin in position, and connect up the Tail Plane Bracing Wires.

True up the Tail Plane to be level transversely and to be square with the Machine.

Check for transverse level by spirit level over the Front and Rear Spars, and check for being square with Machine by taking measurements from Bottom Sockets of Outer Interplane Struts to lateral extremities of Rear Spar of Tail Plane.

These measurements should be the same on both sides.

The Raf-wire should be carefully tensioned up so that the Tail Plane is held firmly and undue tension being avoided.

The Incidence of Tail Plane in its normal position is $1\frac{1}{2}°$ In this position the distance between top Longerons and under surface of the Rear Spar should be $1\frac{5}{16}$". Any adjustments by means of nut and screw can be made after trials.

Hinge Rudder to Fin Sternpost and insert the Split Pins.

The Fin should point directly fore and aft and be square with Machine.

CONTROLS.

With Pilot's Control Stick central the Ailerons should droop $\frac{1}{4}$" below the Trailing Edges of Main Planes.

With Pilot's Control Stick vertical the Elevators should be in direct continuation of the Tail Plane.

With Rudder Bar square in Fuselage the Rudder and Tail Skid should point directly fore and aft and be square with Machine.

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SOPWITH TRIPLANE (SINGLE-SEATER).

(110 H.P. & 130 H.P. CLERGET.)

LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	26′	6″
Span of Intermediate Main Planes	26′	6″
Span of Lower Main Planes	26′	6″
Chord of Upper Main Planes	3′	3″
Chord of Intermediate Main Planes	3′	3″
Chord of Lower Main Planes	3′	3″
Incidence of Upper Main Planes		2°
Incidence of Intermediate Main Planes		2°
Incidence of Lower Main Planes		2°
Stagger of Intermediate Main Planes		18″
Total Stagger		36″
Dihedral of Upper Main Planes		2½°
Dihedral of Intermediate Main Planes		2½°
Dihedral ot Lower Main Planes		2½°
Overall Length	19′	6″
Overall Height	10′	6″
Incidence of Tail Plane (Centre Line) in normal position		1½°
Droop of Ailerons with Control Stick Central		¼″
Wheel Track	5′	6″

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SOPWITH TRIPLANE (SINGLE-SEATER)
(110 H.P. & 130 H.P. CLERGET.)

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that the Leading Edges of the Main Planes are symmetrical about the centre line of Machine.

Check the Stagger.

Examine the Bracing Wires for length and tautness in the Centre Section, and see that the Split Pins are in position, that Lock Nuts are tight, and that Tie Rods for Main Planes are secure.

Check the Dihedral.

Check the Incidence.

See that the Interplane Struts are straight.

Examine all Main Plane Bracing Wires for length and tautness, and see that all Split Pins are in position.

Examine all Controls, Control Pulleys, and Cables, and see that they work freely, and that Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is set correctly, and is square with Machine, that Tail Plane Bracing Wires are correct, both as to tautness and length, that all Split Pins are in position, and that Lock Nuts are tight.

Examine Rudder and Fin and see that they are set straight and square with Machine.

Check the setting of the Ailerons and Elevators

Examine Undercarriage and Skid.

Examine Tank Mountings and Connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories.

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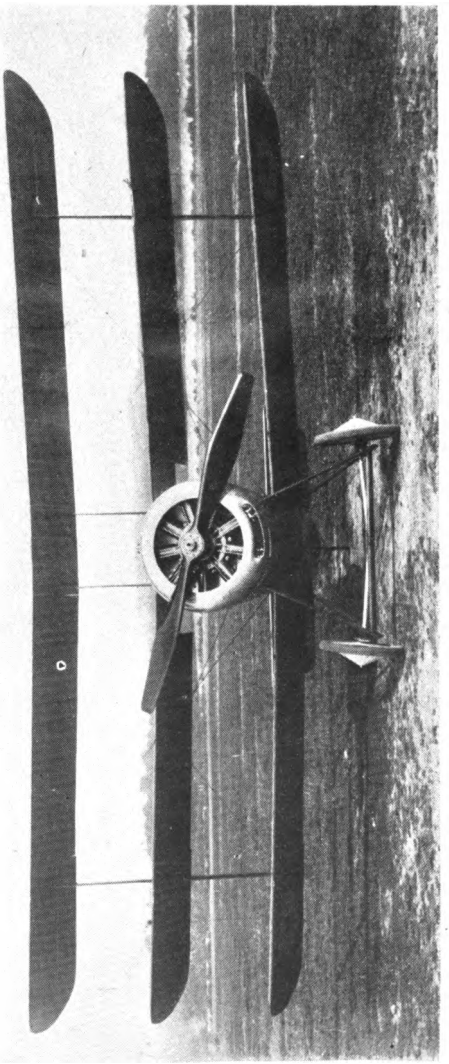
T.5. SOPWITH TRIPLANE (Single Seater) (130 H.P. Clerget).

Fig. 1.



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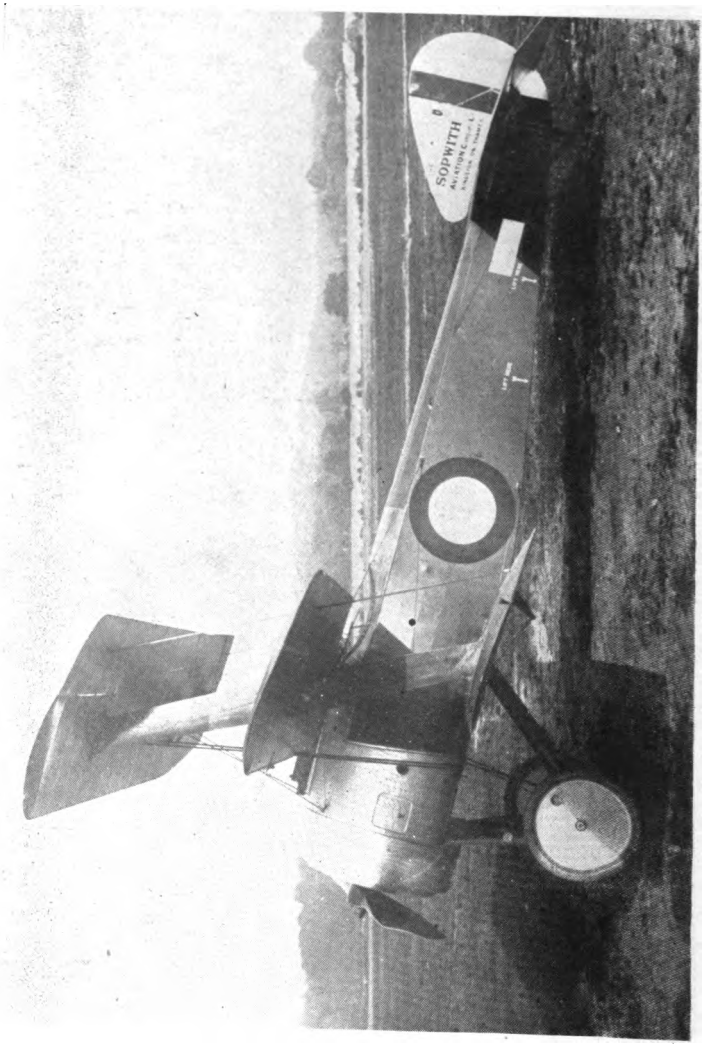
T.5. SOPWITH TRIPLANE (SINGLE SEATER) (130 H.P. CLERGET).

FIG. 2.



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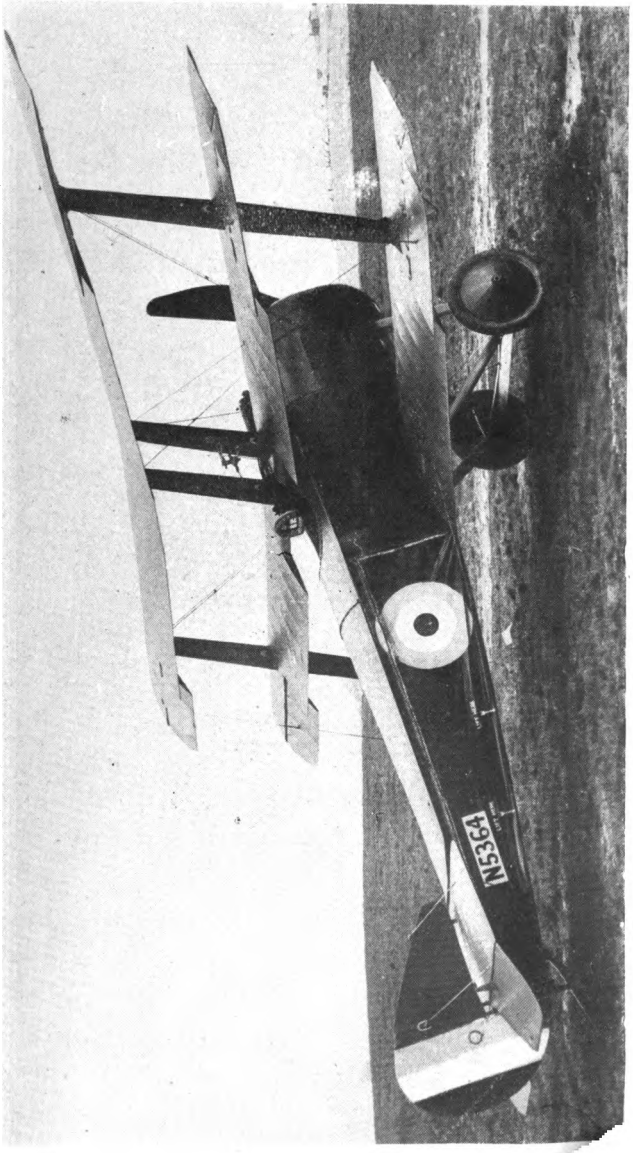
T.5. SOPWITH TRIPLANE (SINGLE SEATER)
(130 H.P. CLERGET). FIG. 3.



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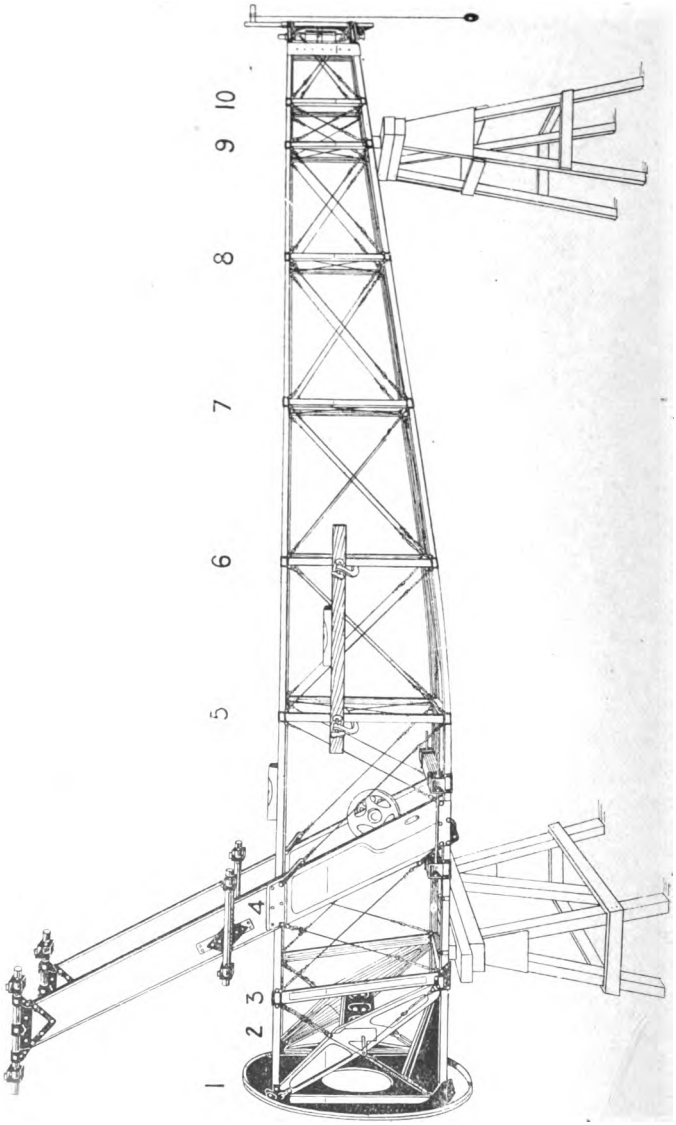
T.5. SOPWITH TRIPLANE (Single Seater) (110 H.P. and 130 H.P. Clerget).

Fig. 4.



Truing up Fuselage.

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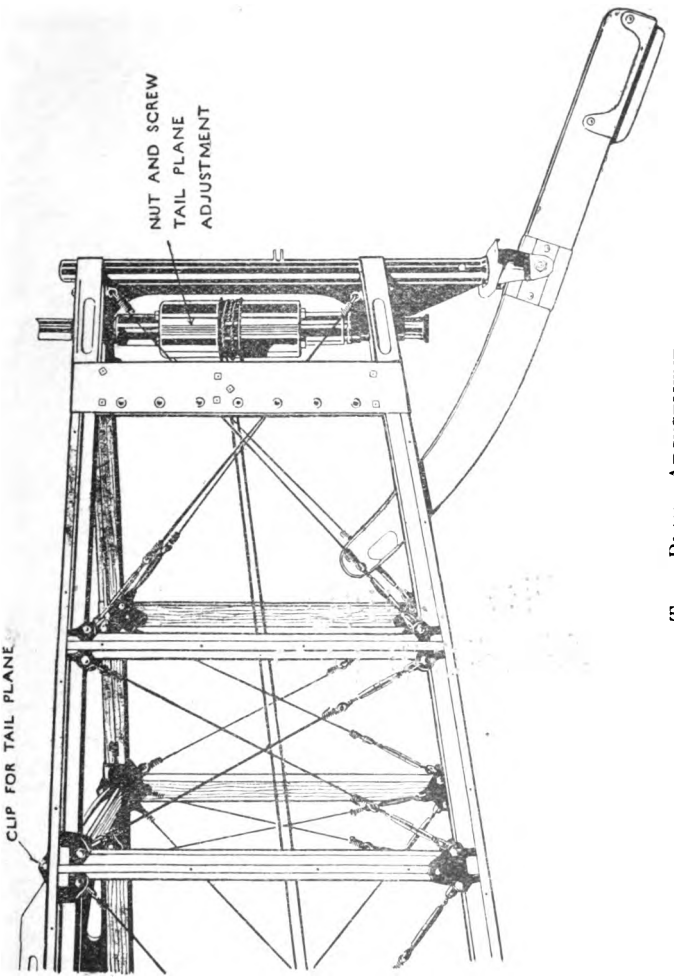
T.5. SOPWITH TRIPLANE (Single Seater) (110 H.P. and 130 H.P. Clerget).

Fig. 7.



Tail Plane Adjustment.

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SOPWITH TRIPLANE (SINGLE-SEATER).

(110 H.P. AND 130 H.P. CLERGET.)

RIGGING DIAGRAMS.

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SPAD BIPLANE, TYPE S. VII.

150 H.P. HISPANO-SUIZA.

RIGGING NOTES.

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SPAD BIPLANE.

TYPE S VII.

150-H.P. HISPANO-SUIZA.

MANUFACTURERS' ORDER OF ERECTION.

1. Fuselage assembled and trued up. Tail Skid fitted.
2. Main Petrol Tank fitted with Fuselage in Inverted Position.
3. Undercarriage fitted and trued up.
4. Engine mounted with Machine in Flying Position.
5. Cowl fitted.
6. Main Planes attached with Machine in Flying Position (Lower Main Planes first).
7. Controls connected up and adjusted.
8. Fuselage covered and doped.

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SPAD BIPLANE, TYPE S.VII.
(150 H.P. HISPANO-SUIZA).

TRUING UP FUSELAGE (See Fig. 1).

The Fuselage Struts are numbered from front to rear of Machine.

Place the Fuselage with Top Longerons uppermost on two trestles, one between Struts 1 and 2 and the other under the last bay.

Pack up with blocks so as to level the Top Longerons as far as possible.

Mark points on Struts 2, 4, 6, 8 on both sides of Fuselage 9in. below *top* face of Top Longerons.

Lightly clamp straightedges transversely between corresponding marked Struts, the marked points to be on the upper edges.

Mark middle points of all Cross Struts, and mark another lot of points half an inch to one and the same side of all these points.

By means of jigs fitting over the Rudderpost and Engine Bearers (see sketch on Page 11) the *true centre line* of Machine is found. From this a line is stretched half an inch *out of centre* on the *same* side as the second lot of marked points on the Cross Struts, the object being to prevent the plumb lines fouling the Fairing Stringers.

Then by means of the Fuselage Bracing Wires true up until all straightedges are level transversely.

Adjust for longitudinal level also, using a long straightedge, over the faces of the transverse straightedges for this purpose.

Plumb lines from the second marked point on any Top Cross Strut should cut the corresponding point on the Bottom Cross Strut and the line half an inch out of centre.

TRUING UP UNDERCARRIAGE.

By means of the front and rear Cross Bracing Wires true up the Undercarriage so that corresponding diagonals are equal. Check by trammel. (See Figs. 2 and 5.)

PLACING MACHINE IN FLYING POSITION.

Before truing up Centre Section and attaching the Main Planes it is necessary to get the Machine in Flying Position.

To do this block the Machine up under the Undercarriage Struts and support the Tail by a trestle placed near the Rudderpost.

Mark points on Struts 2 and 3 on both sides of Fuselage at equal distances below the *under* surface of the Top Longerons.

NOTE.—The "Figs." refer to the illustrations and *not* to the Rigging Diagrams.

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Spad Biplane, Type S VII. (150 H.P. Hispano-Suiza).

Fix a straightedge longitudinally to the marks on each side and level by raising or lowering Tail.

Level transversely by packing blocks under the Undercarriage Struts.

TRUING UP CENTRE SECTION.

By means of the Adjusting Steel Tubes and side Cross Bracing Wires true up the Centre Section so that the Struts are vertical when viewed from the front, and so that the Sockets on tops of the Struts will correspond to the fittings on the Upper Main Plane; check by trammel. (See Figs. 2 and 3).

A plumb line from the centre of Top Socket on Front Centre Section Strut must pass across the centre of the hole in the Bottom Longeron into which the Front Spar of Lower Main fits; check both sides. (See Sketch, Page 10 and Fig. 5.) Similarly for the Rear Centre Section Struts.

N.B.—The Centre Section should be trued up *before* mounting the Upper Main Plane.

FITTING LOWER MAIN PLANES.

See that the Lower Main Planes have the Bell Crank Aileron Control Levers properly bolted in position.

See that the Rods connecting Pilot's Control Stick and Bell Crank Levers are loosely inserted in the Lower Main Planes, and are not bent or damaged.

Place the Lower main Planes in position, inserting the projecting portions of the Spars at the root into the recesses in the Bottom Longerons, also passing the horizontal Aileron Connecting Rods through the holes in the Bottom Longerons just behind the Rear Spar holes (see Fig. 5), but not securing them either to Pilot's Control Stick or Bell Crank Lever until the Planes have been trued up.

Support the Planes near the Wing Tips on trestles.

Join up the Piano Wires at the *bottom* of the Fuselage which connect the Spars of the Lower Main Planes.

INTERPLANE STRUTS AND FITTINGS.

The two halves of the Intermediate Struts, Front and Rear the horizontal connecting Strut, and the cables connected to the fittings to which all are attached are connected up away from the Machine.

Fit all the Struts in position on the Lower Main Planes. (See Fig. 6.)

The Struts are secured to the Wiring Plates on the Planes by Pins, which are prevented from coming out by ordinary domestic *Safety Pins*, and *not* by *Split Pins*.

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Spad Biplane, Type S VII. (150 H.P. Hispano-Suiza).

FITTING THE UPPER MAIN PLANE.

The Upper Main Plane is lifted into position and bolted to the Sockets on the tops of the Centre Section Struts.

The *Bolts* pass from the *under surface* to the *upper surface*, the *Nuts* being on *top*. *Spring Washers* are fitted *under* the *Nuts*.

The Intermediate and Outer Struts are fitted to the Upper Main Plane in the same way as they are to the Lower Main Planes, i.e., by Pins passing through the Fork End Fittings, and secured by *Safety Pins*.

Loosely connect up all Landing, Flying, and Incidence Wires.

After mounting the Upper Main Plane in position connect the Leads to the Petrol and Water Tanks in the Centre Section of the Upper Main Plane.

IMPORTANT.—The Bolts securing the Strut Fittings on the Upper Main Plane pass from *under surface* to *upper surface*, and those securing Strut Fittings to the Lower Main Planes from *top surface* to *under surface*.

TRUING UP MAIN PLANES.

All Interplane Struts must be vertical when the Machine is in Flying Position.

There is no *Dihedral*.

The *Stagger* is 45mm.*

This should be checked by dropping a plumb line from the Leading Edge of the Upper Main Plane; the fore and aft horizontal distance of this line in front of the Leading Edge of the Lower Main Plane should be 45mm.* when the Machine is in Flying Position.

The centre of the fitting to which both halves of the Intermediate Struts are fitted is the mid point of the diagonals along which the Landing and Flying Wires lie. (See Fig. 6.)

Check by trammel from this centre point to centre points on Strut fittings and ensure that these distances are equal.

Leading Edges of Upper and Lower Main Planes should be straight transversely, and at right angles to the longitudinal axis of the Machine.

The *Incidence* of the Lower Main Planes is 1deg. 30min. (1½deg.) throughout.

Check by straightedge and protractor or Abney level, taking care to place the straightedge from Leading Edge to Trailing Edge at *Ribs* of the Lower Main Planes.

The *Incidence* of the Upper Main Plane is 2° throughout. Check as for Lower Main Planes.

There is no "*Wash In*" or "*Wash Out*."

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* The Stagger is 45mm. according to design, but in practice it is found that 43mm. is the average value as measured on a large number of Machines.

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Spad Biplane, Type S VII. (150 H.P. Hispano-Suiza).

The distance from the centre of *Inner Bolt* at *foot* of Front Outer Strut to centre of Propeller Boss should be 10ft. 5⅜in. on both sides.

The distance from the centre of *Inner Bolt* at *foot* of Front Outer Strut to centre of *Lower Front Bolt* on side of Rudder Plate should be 17ft. 0⅛in. on both sides.

AILERON CONTROLS.

After truing up the Main Planes connect the vertical Aileron Control Rods along the Rear Outer Struts to the Kingpost on the Ailerons and to the Bell Crank Aileron Control Levers, not forgetting the *Split Pins*. Then fit the Fork Ends of the horizontal Aileron Connecting Rods in the Lower Main Planes to the Pilot's Control Stick. The latter rods are then adjusted by turning them until they fit in position in the Bell Crank Levers when the Pilot's Control Stick is central. (See Fig. 7.)

The *Droop* of the Ailerons is a quarter of an inch.

FIXING THE EMPENNAGE.

Pass the Rudder and Elevator Control Wires through the Tail Plane connecting the latter wires to the Kingpost, inside the Tail Plane, which controls the Elevator.

Bolt the Tail Plane to the top of the Fuselage and insert the *Split Pins*. Tail Plane to be packed up 3-16in. in rear (result of tests up to 6/5/17).

Bolt up the two steel Supporting Tubes and adjust them so that the Tail Plane is square with the Machine. (See Fig. 4.)

This can be checked by aligning the Trailing Edge of Upper Main Plane and Rear Spar of Tail Plane.

Bolt the Fin in position.

Hinge the Rudder to the Rudderpost by passing the long Cotter Pin through the *Eye Bolts* on Rudder and Rudderpost, and secure the eye end at the bottom of the Rudder Cotter Pin to the lowest *Eye Bolts* on the Rudder and Rudderpost by wire.

Connect the Rudder Control Wires.

Adjust the Controls so that when the Rudder Control Bar is square with Fuselage the Rudder is pointing directly *fore* and *aft*, and is square with the Machine, and when the Pilot's Control Stick is central, but leaning forward ¾in., there is no *Droop* on the elevators.

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SPAD BIPLANE TYPE S. VII.
(150 H.P. HISPANO-SUIZA.)

WATER CIRCULATION.

In order to ensure a *constant pressure of water* over the cylinders, a small Tank is placed in the front part of the Centre Section of the Upper Main Plane.

To obtain the best results, it is necessary to prevent all Air Pockets, and to effect this the following procedure is strongly recommended by the Manufacturers :—

1. Place the Machine in Flying Position.
2. Remove Stopper from top of Radiator.
3. Open Tap or Plug placed in top of Carburetter.
4. Fill up with *distilled* or *rain water* (adding about 1½ gallons of glycerine in Winter through Radiator Filler).
5. Replace Radiator Stopper.
6. Remove small Tank Stopper and open small Tap placed under Tank.
7. Pour water into Tank until it runs out at top of Carburetter, then close Carburetter Tap, and continue to pour water until it begins to run out at Tank Overflow Tap. At this point stop filling (*the Tank should then be about half full*) and close the Tap.
8. Start Engine and let it run for 3 or 4 minutes until temperature rises to about 48° in Summer and 65° in Winter.
9. *Stop Engine.* Open Tap or Plug over Carburetter until water begins to run out, add to Top Tank sufficient water to bring water back to previous level (par. 5).
10. Run Engine, one, two, three or four times, letting air out each time at top of Carburetter and examine level of water in Top Tank each time, until no more water is required.

NOTE :—The Stopper of the Radiator is placed *behind* that of the Oil Filler.

If the foregoing instructions are not properly carried out, the result will be a stoppage of Water Circulation to the Radiator, and will probably be followed by the *bursting* of the Top Tank or some other part of the Water Circulation. The Thermometer might not indicate the rise in temperature if the water had completely run out. If there is not sufficient water, owing to either bad filling up or from leakage, *Steam Pockets* will form, and the temperature will rise very rapidly.

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SPAD BIPLANE. TYPE S. VII.
150 H.P. HISPANO-SUIZA.

LIST OF PRINCIPAL DIMENSIONS.

SPAN OF UPPER MAIN PLANE - - -	25′ 8″
CHORD OF „ „ „ - - -	4′ 7″
INCIDENCE OF „ „ - - -	2°
DIHEDRAL - - - - - - - - -	Nil
SPAN OF LOWER MAIN PLANES - - -	(approx.) 25′
CHORD „ „ „ - - -	4′ 2″
INCIDENCE OF „ „ - - -	1½°
GAP - - - - - - - - - -	3′ 8½″
STAGGER - - - - - - - - -	45mm.
DROOP OF AILERONS - - - - -	¼″
DROOP OF ELEVATORS (with Pilot's Control Stick ¾in. forward) - - - - - -	NIL
OVERALL LENGTH - - - - -	(approx.) 20′ 3½″

PB - - - - - - -	10′ 5⅝″	Measurements (approx.)
BR - - - - - - -	17′ 0⅛″	

where:—

P is CENTRE of PROPELLER BOSS.

B is CENTRE of BOLT at foot of FRONT OUTER INTERPLANE STRUT.

R is CENTRE of LOWER FRONT BOLT on side of RUDDER PLATE.

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SPAD BIPLANE.

Type S VII.

150-H.P. HISPANO SUIZA.

POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that Leading Edges of Main Planes are straight in plan view.

Examine all Bracing Wires for length and tautness in the Centre Section, and see that Split Pins are in position.

Check Planes for level (no Dihedral).

Check Planes for Overhang (the term "Overhang" is used in preference to Stagger, as the Interplane Struts are vertical and Overhang is caused by Lower Main Planes having a smaller Chord than Upper Main Plane).

Check Planes for Incidence.

See that Interplane Struts are straight, and that Safety Pins are in position.

Examine all Main Plane Bracing Wires for length and tautness and see that all Split Pins are in position.

Examine all Cables and Controls and see that same work freely and that all Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is correctly set and is square with Machine and that all Tail Plane Bracing Stays are correct both as to length and tautness, and that all Split Pins are in position.

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Spad Biplane, Type S VII. (150-H.P. Hispano Suiza)

Points to Observe when Overhauling Machine.

(Continued.)

Check Main Planes for square with Fuselage and Propeller Boss.

Examine Elevator Control Mechanism and see that it works freely.

Examine Rudder and Fin and see that they are set straight and square with Machine.

Measure the Droop of the Ailerons.

Examine Undercarriage.

Examine Tank Mounting and Connections.

Examine Engine Mounting, Engine Controls and Engine Accessories.

Examine Gun Mounting and Gear and check for alignment with Engine, also check Sights for alignment with Gun.

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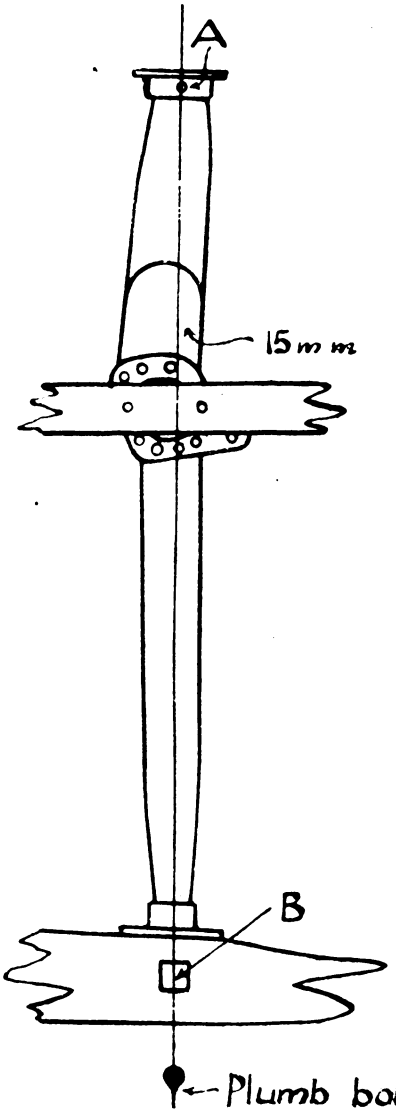
T.5. SPAD BIPLANE, TYPE S.VII.
(150 H.P. Hispano-Suiza).

TRUING UP CENTRE SECTION.



A.—Centre of Bolt on Front Strut Upper Socket.

B.—Centre of recess in Bottom Longeron for Lower Plane Front Spar.

A B must be vertical when Machine is in Flying Position.

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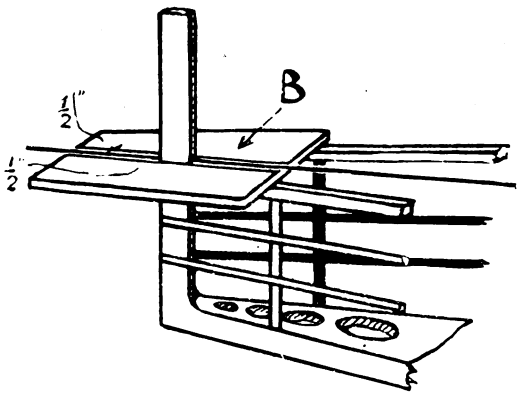
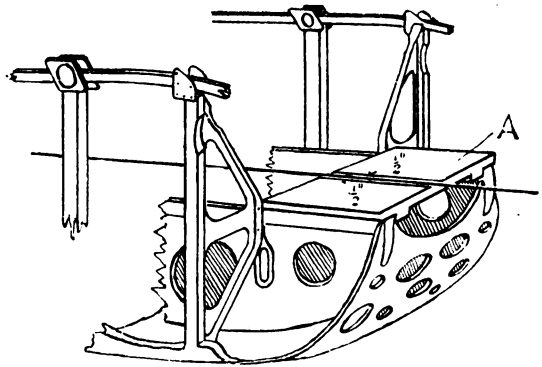
OBTAINING TRUE CENTRE LINE OF FUSELAGE.



B.—Board with hole accurately fitting Rudderpost and Resting on Top Longerons, marked with true centre line and one parallel line on each side ½ in. from centre line.



A.—Board fitting accurately between Engine Bearers and marked with true centre line and one parallel line on each side ½in. from centre line.

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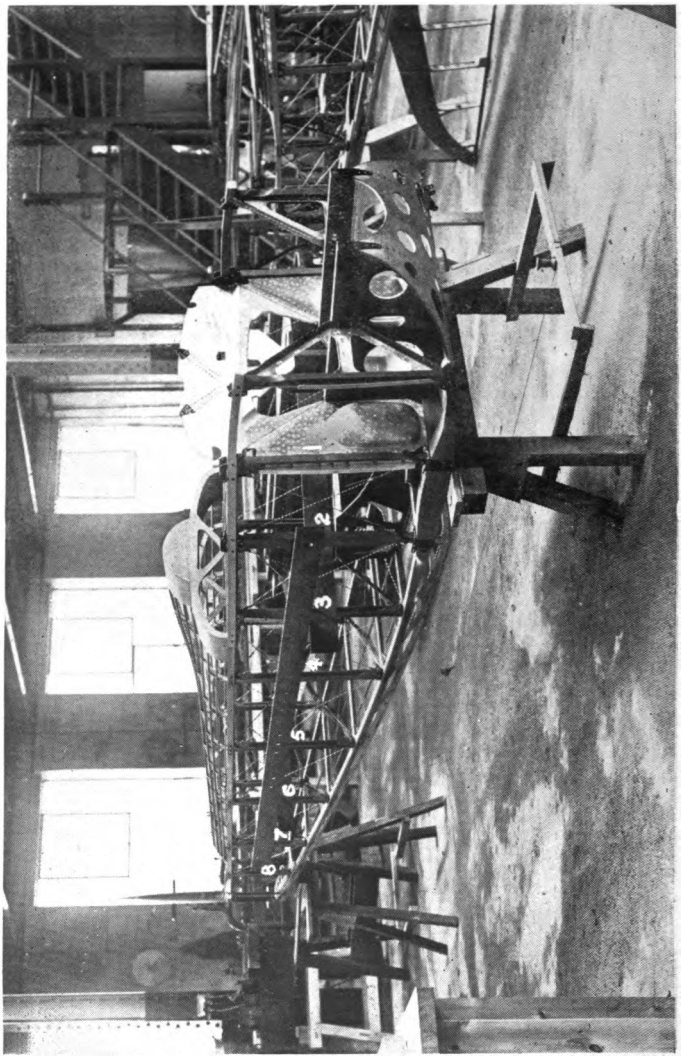
T.5. SPAD BIPLANE. TYPE S. VII. (150 H.P. HISPANO-SUIZA).
FIG. 1.



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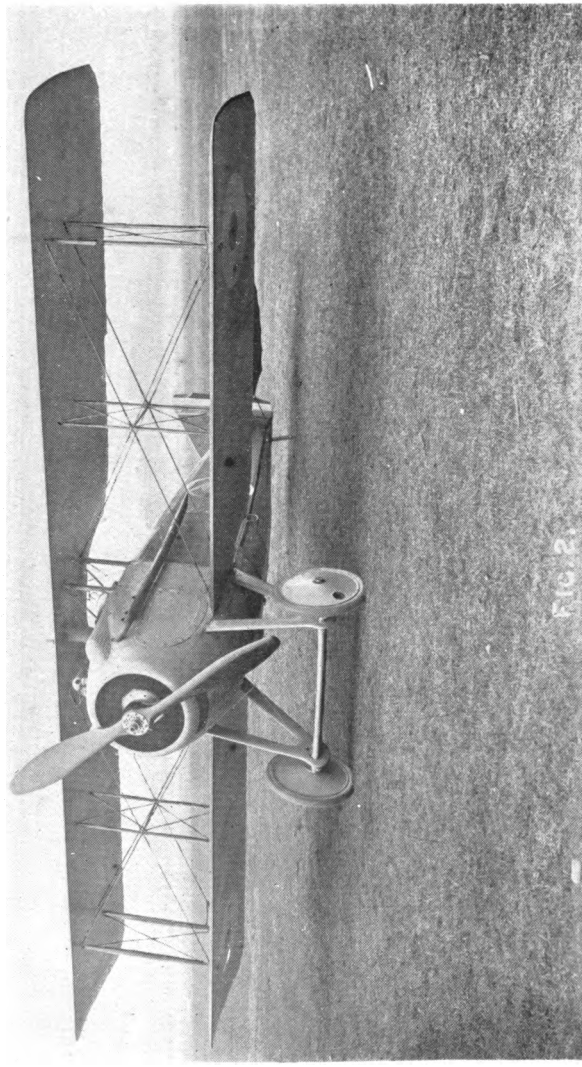
T.5. SPAD BIPLANE. TYPE S. VII. (150 H.P. HISPANO-SUIZA).
FIG. 2.



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T.5. SPAD BIPLANE. TYPE S. VII. (150 H.P. HISPANO-SUIZA).
FIG. 3.

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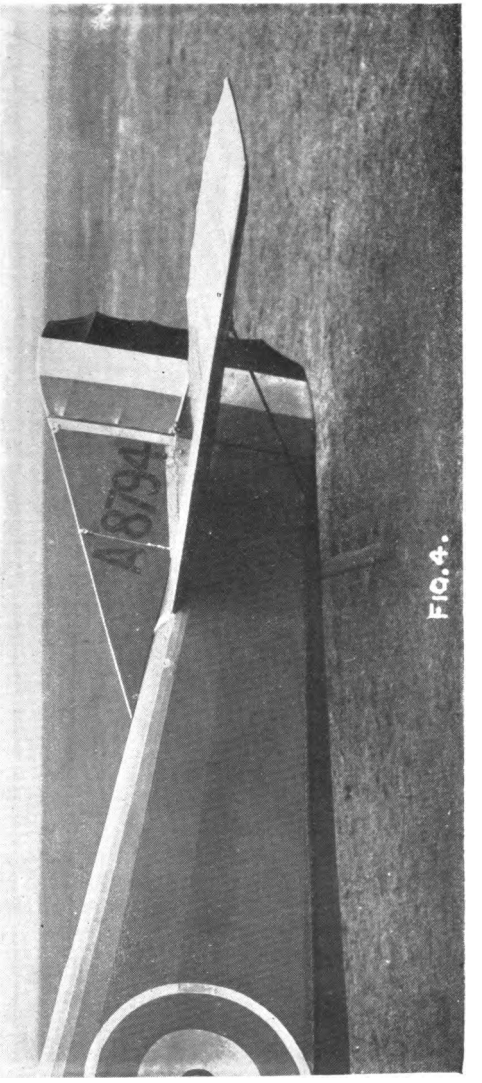
T.5. SPAD BIPLANE. TYPE S. VII. (150 H.P. HISPANO-SUIZA)
FIG. 4.



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T.5. SPAD BIPLANE. TYPE S. VII. (150 H.P. HISPANO-SUIZA).
FIG. 5.

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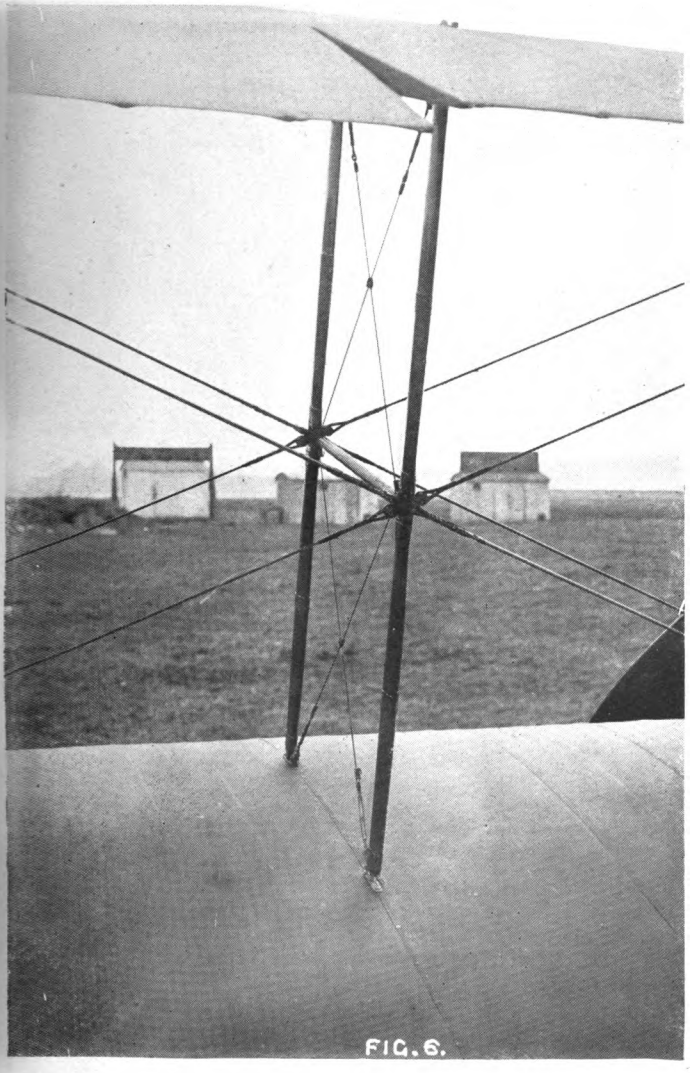
T.5. SPAD BIPLANE. TYPE S. VII. (150 H.P. HISPANO-SUIZA).
FIG. 6.



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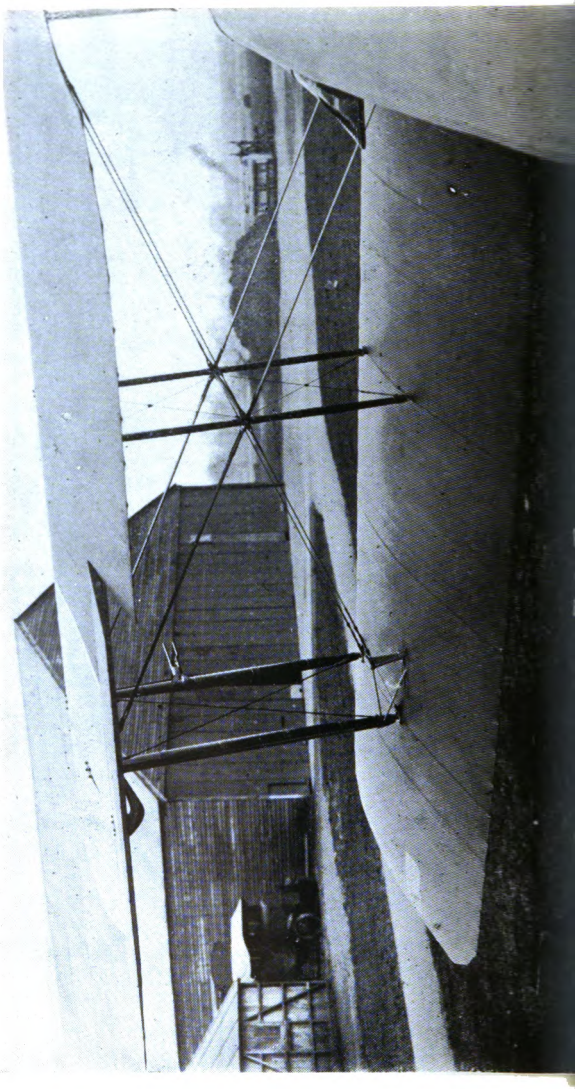
T.5. SPAD BIPLANE. TYPE S. VII. (150 H.P. HISPANO-SUIZA)
FIG. 7.



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SPAD BIPLANE, TYPE S. VII.

150 H.P. HISPANO-SUIZA.

RIGGING DIAGRAMS.

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T.5.

SPAD BIPLANE (TYPE S.VII)

150. H.P. HISPANO-SUIZA.

FIG 1
SIDE ELEVATION

FIG 2
FRONT ELEVATION
OF CENTRE SECTION

TRUING UP

Flying Position

Machine is in Flying Position when top longerons are horizontal Iron bar strut to tail, and must be in this position before truing up Centre Section and attaching main planes.

Fuselage

Start at front of Machine and working towards the tail adjust the top, bottom and internal bracing wires making corresponding diagonals equal. Check with trammels. Upper longerons must appear perfectly straight when viewed from the side. Adjust with side bracing wires and check with straightedges and spirit levels Fuselage must be symmetrical about centre line of Machine

Undercarriage

Undercarriage must be symmetrical about vertical centre line of machine. Adjust with cross bracing wires making them equal.

TRUING UP

Centre Section

The Centre Sections is trued up before fitting upper main plane. Centre section struts must be vertical when viewed from the front, leading edges of front struts must be 15%. and leading edge of Rear struts must be 35% from plumb lines dropped from Centres of Upper Main Plane Spars to Centres of Lower Main Plane Spars Front Spar of Upper Main Plane must be vertically over Front Spar of lower main planes. True up centre section by adjusting tubes and side cross bracing wires so that fittings on top of four centre section struts correspond to fittings on upper main plane Check by trammel

3 Sheets.
Sheet 1.

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T.5.

SPAD BIPLANE (TYPE S.VII)

150. H.P. HISPANO-SUIZA.

FIG 3
FRONT ELEVATION

FIG 4
END ELEVATION
MAIN CELL

MAIN CELL

Interplane Struts

Interplane Struts must be vertical with machine in flying position. The intermediate struts and wires connected to them are assembled away from machine. All struts are secured by fittings on plates pinned and locked by safety pins.

Dihedral

There is no dihedral on upper or lower plates. Check with a long straightedge along the leading edge of Upper plane. 64 ± 0.5 = 0.64 ± 0.05. Check by templates.

Incidence

Lower Main Plane 1° 30' to fuselage. Upper Main Planes 0° throughout. Check by straightedge and Abney Level.

Stagger

Drop a plumb line from the leading edge of Upper Main Plane Horizontal measurement from plumb line to leading edge of Lower Main Planes must be 45 ± 0.5 mm. Check throughout the leading edge of Main Planes.

Ailerons

Set the ailerons so that their trailing edges are 4" below trailing edge of Upper plane.

3 Sheets
Sheet 2

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T.5.

SPAD BIPLANE (TYPE S.VII)

150. H.P. HISPANO-SUIZA.

Rudder
Elevator
Tail
Plane
Fin
Elevator
EMPENNAGE
Rudder must point directly aft and elevators form a continuation of tail plane when control lever is forward and foot control bar is square with centre line of fuselage.
Tail Plane packed up 3° at rear
17 0
Fuselage
Pilot's Seat
Port Aileron
23 - 6½
Upper Main Plane
10 - 3½
10 - 3½
Starboard Aileron
MAIN PLANES
The Main Planes have their leading edges straight and at right angles to the centre line of fuselage. Distance from centres of inner bolt (p) at foot of front outer strut is 17 - 0 from centre of lower front bolt (r) at side of rudder plate and 10 - 3½ from centre (p) of propeller boss. These measurements are the same on both sides.

FIG 5
GENERAL PLAN

3 Sheets
Sheet 3

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(100 H.P. MONOSOUPAPE.)

RIGGING NOTES.

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MANUFACTURER'S ORDER OF ERECTION.

---

1 Nacelle placed in Flying Position.

2. Upper Centre Section Plane fitted.

3. Lower Main Planes fitted.

4. Upper Main Planes fitted.

5. Tail Booms and Empennage fitted.

6. Controls connected up and adjusted.

7. Undercarriage fitted.

8. Engine mounted.

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PLACING NACELLE IN FLYING POSITION.

Support the Nacelle on two low trestles. Fit a Jig between Engine Plates to give the true centre line of the Engine Shaft.

The Nacelle is in Flying Position when it is level transversely and the centre line of Engine Shaft is horizontal. Level transversely off the Rear Bottom Cross Strut of the Nacelle, and level longitudinally off the centre line of Engine Shaft. Check in both cases by spirit level.

TRUING UP CENTRE SECTION.

The Centre Section must be symmetrical about the vertical centre line of Machine, and all Centre Section Struts must be vertical viewed from front and side.

Make transverse adjustments by Front and Rear Cross Bracing Wires, making corresponding diagonals equal, and check by trammel.

Make longitudinal adjustments by Side Cross Bracing Wires; check Struts for being vertical by plumb lines.

ATTACHING THE LOWER MAIN PLANES.

Fit Lower Main Planes in position, supporting the Wing Tips on low trestles.

Secure the Spars to the Nacelle, not forgetting to insert the Split Pins.

ATTACHING THE UPPER MAIN PLANES.

Support the Upper Main Planes in an inverted position on low trestles.

Fit all Wiring Plates, Control Pulleys and Control Cables. Fit Interplane Struts (not forgetting the Split Pins), and by means of the latter lift the Main Planes bodily in position and bolt to Centre Section Plane, fit the Bottom Ends of the Interplane Struts to the Lower Main Planes, and insert all Split Pins.

Loosely connect up all Landing, Flying and Incidence Wires.

NOTE.—The Rear Interplane Struts are ¼" longer than the Front Interplane Struts.

TRUING UP THE MAIN PLANES.

Drop plumb lines from six points, three each side, from the Leading Edge of Upper Main Planes.

The *Dihedral* is 1½° for both Upper and Lower Main Planes. Adjust by Landing Wires, front and rear, on both sides. Check by Abney level and straightedge along Front and Rear Spars.

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The *Incidence* is 3° throughout for both Upper and Lower Main Planes. Adjust by Incidence Wires.

Check by Abney level and straightedge, placing the latter along the chord of a Rib.

There is no *Stagger*.

The plumb lines dropped from the Leading Edge of Upper Main Planes should just touch the Leading Edge of Lower Main Planes, and all six plumb lines should be in line viewed from the side.*

All Interplane Struts must be straight and vertical.

Check for Main Planes being square with Machine by taking measurements from Top and Bottom Sockets of Front Outer Struts to Front Drag Wiring Plates. Corresponding measurements should be the same on both sides.

After Truing up the Main Planes connect up and tension the Front Drag Wires.

TAIL BOOMS AND EMPENNAGE.

The Tail Booms and Empennage are assembled away from the Machine, and the whole lifted into position, and the Front Ends of the Booms bolted to the Rear Spars of the Main Planes, being secured to the latter by Castle Nuts and Split Pins.

The Top Booms must be straight and horizontal with Machine in Flying Position. Check oy long straightedge and spirit level along the Booms.

All Interboom Struts must be straight and vertical.

Check each Strut by plumb line, and make adjustments by Side Boom Bracing Wires. Check for Main Planes being Square with Centre line of Machine by taking measurements from Top and Bottom Sockets of Rear Outer Struts to Rudder Post. Corresponding measurements must be the same on both sides.

The Rudder Post must be vertical, and thus should be checked by plumb line.

The Fin should be set so that a point on *axis* of Centre Trunnion Tube midway between Leading Edge of Fin and Trunnion Centres is 1″ to the right of longitudinal centre line of Machine. To check, drop a plumb line from this mid point, making sure that this line passes through the *axis* of the Trunnion Tube.

Place a straightedge symmetrically across the Bottom Booms, and so that its edge just touches the plumb line. The point of contact of plumb line and straightedge should be 1″ to the right of the point (on straightedge) mid-way between the Bottom Booms.

* On account of Dihedral the inner plumb lines will be slightly in front of the outer lines, but for practical purposes all may be regarded as in line.

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The Tail Plane should be set so that its centre line is horizontal with Machine in Flying Position.

The Tail Plane is set correctly when the Fixing Bolt passes through the Upper Hole in Tail Plane Box Clip and through the Centre Hole in Fin Clip.

NOTE.—The Fixing Bolt is secured by Castle Nut and Split Pin.

Check for Tail Plane being square with Machine by taking measurements from Bottom Sockets of Rear Outer Struts to lateral extremities of Rear Spar of Tail Plane. Corresponding measurements should be the same on both sides.

CONTROLS.

With Pilot's Control Stick central the Ailerons should be in continuation of Main Planes.

With Pilot's Control Stick leaning 1" forward, Elevators should be horizontal.

With Rudder Bar square in Nacelle, the Rudder must be in continuation of Fin.

TRUING UP THE UNDERCARRIAGE.

The Undercarriage is symmetrical about the vertical centre line of Machine. Adjust by Rear Cross Bracing Wires, making corresponding diagonals equal, and check by trammel.

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LIST OF PRINCIPAL DIMENSIONS.

Span of Upper Main Planes	33′ 9″
Span of Lower Main Planes	33′ 9″
Chord of Upper Main Planes	5′ 6″
Chord of Lower Main Planes	5′ 6″
Incidence of Upper Main Planes	3°
Incidence of Lower Main Planes	3°
Dihedral of Upper Main Planes	1½°
Dihedral of Lower Main Planes	1½°
Stagger	Nil.
Gap (from centre of Upper Spar to centre of Lower Spar)	6′ 0″
Over-all Length	28′ 5½″
Height	11′ 6″
Tail Span	14′ 3″
Droop of Ailerons (with Pilot's Control Stick central)	Nil.
Position of Elevators (with Pilot's Control Stick leaning 1″ forward)	Horizontal.
Wheel Track	5′ 10½″

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POINTS TO OBSERVE WHEN OVERHAULING MACHINE.

See that Leading Edges of Main Planes are symmetrical about centre line of Machine.

Examine Bracing Wires of Centre Section and Main Planes, and see that they are correct both as to length and tautness, and that all Lock Nuts are tight.

Check the Dihedral.

Check the Incidence.

See that there is no Stagger, and that Interplane Struts are straight and vertical with Machine in Flying Position.

Examine Tail Booms and see that they are straight, and Bracing Wires are correct both as to length and tautness, that all Split Pins are in position, and that Lock Nuts are tight.

See that Interboom Struts are straight and vertical with Machine in Flying Position.

Examine all Control Pulleys and Cables and see that they work freely, and that all Turnbuckles on Cables are locked.

Examine Tail Plane and see that it is set correctly, and that Tail Plane Bracing Wires are correct both as to length and tautness, that all Split Pins are in position, and that Lock Nuts are tight.

Examine Rudder and Fin, and see that they are set correctly.

See that the Ailerons and Elevators are set correctly.

Examine Undercarriage and Tail Skid.

Examine Tank Mountings and connections.

Examine Engine Mounting, Engine Controls, and Engine Accessories.

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FIG. 1.

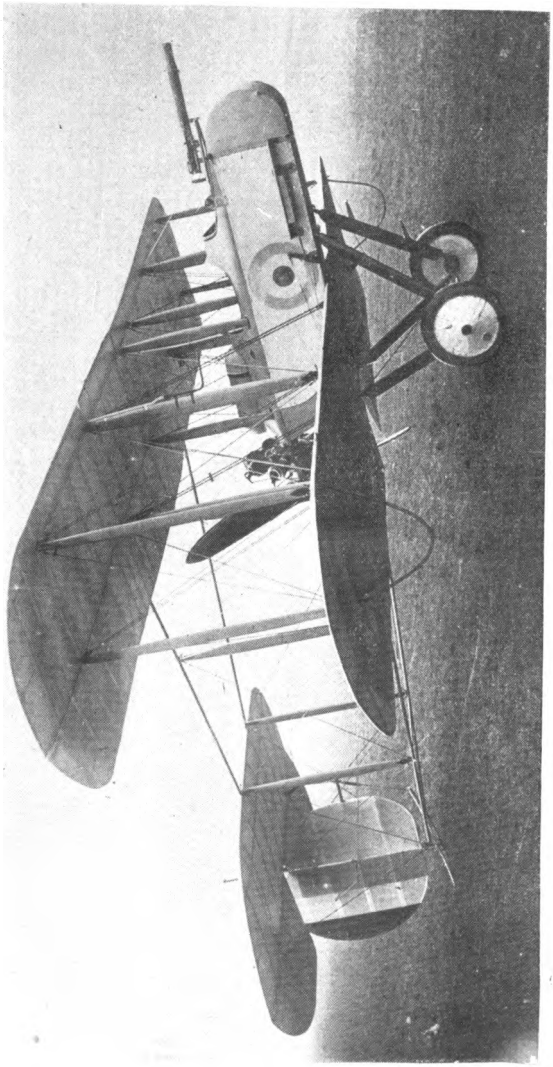

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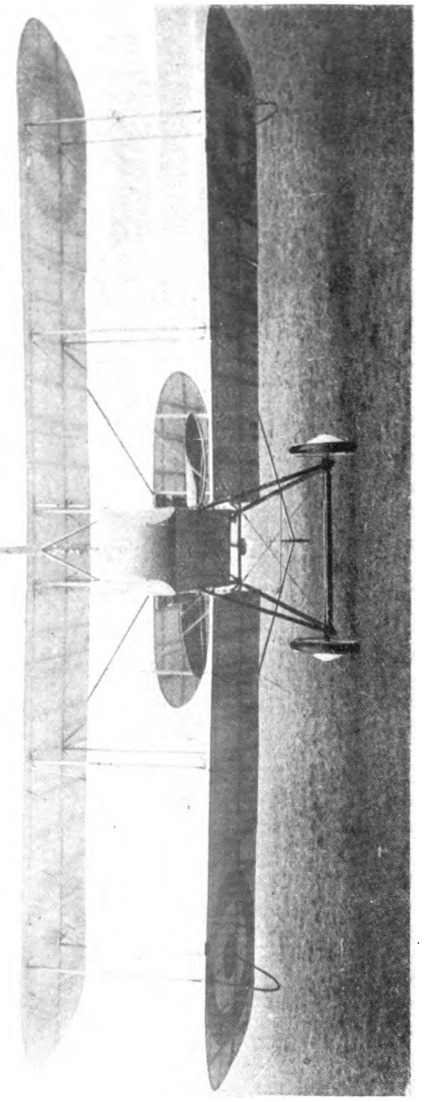
Fig. 2.



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T.5. VICKERS F.B.9 (100 H.P. MONOSOUPAPE.)
FIG. 3.

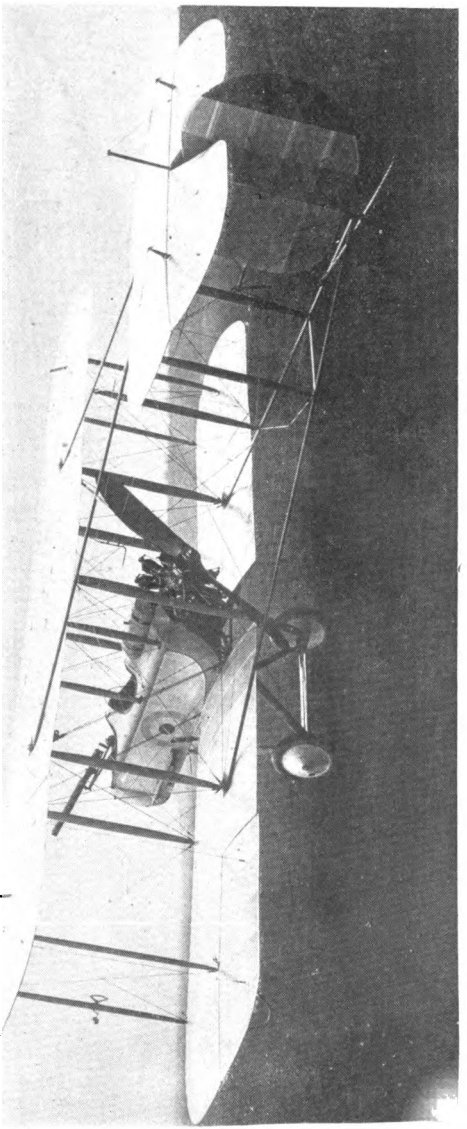

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Fig. 4.

Centre Section.

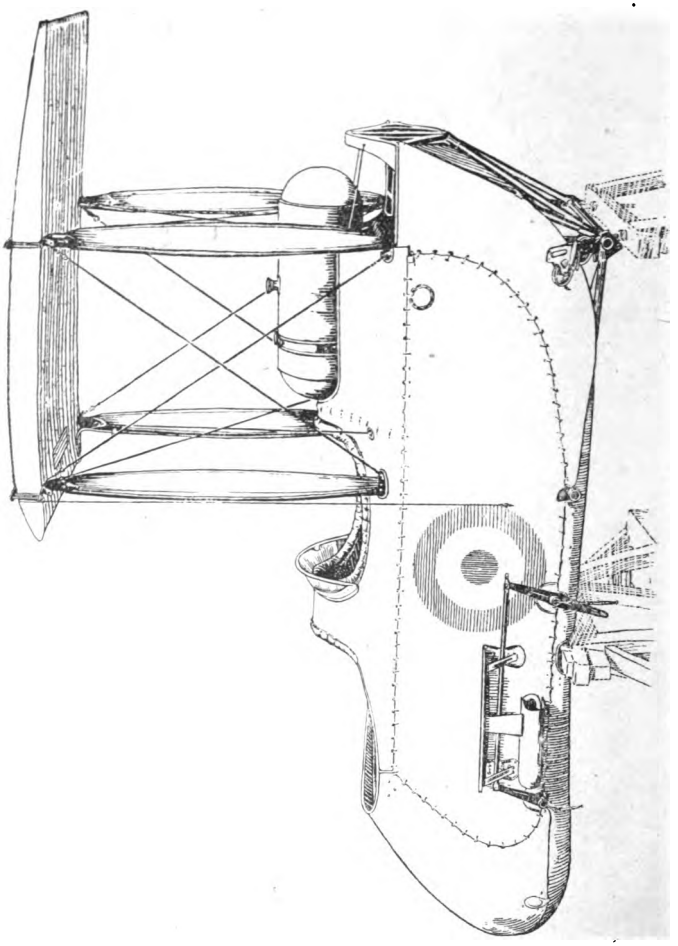

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FIG. 5. CENTRE SECTION.

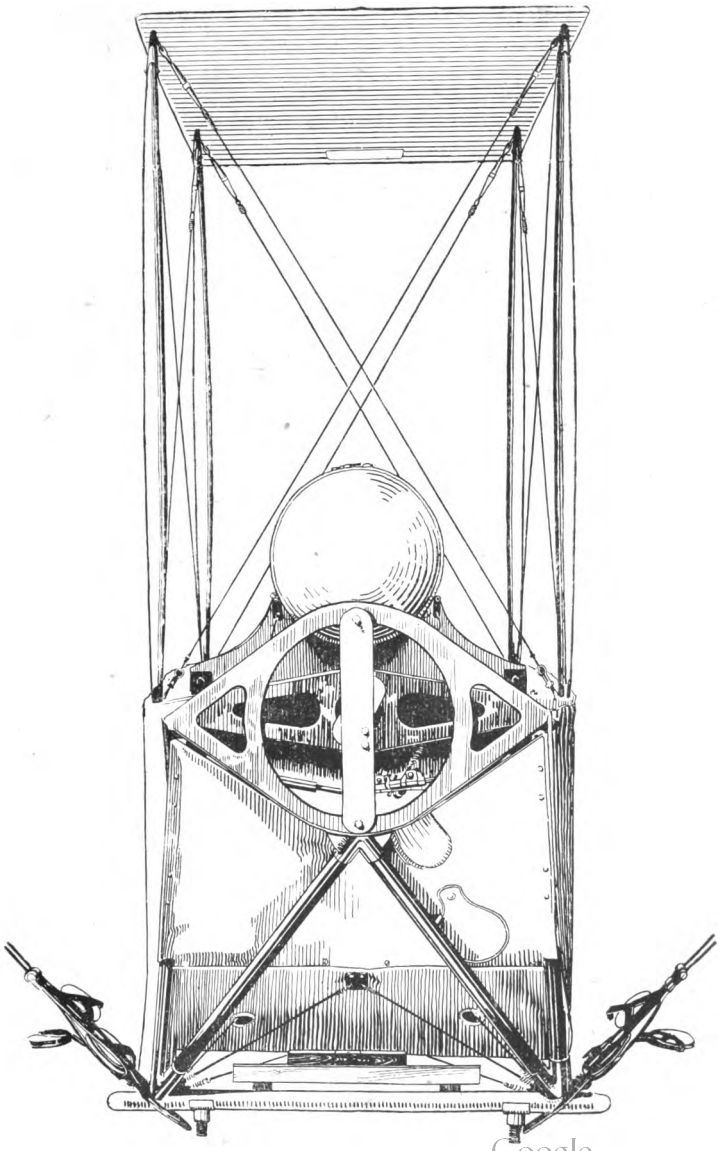

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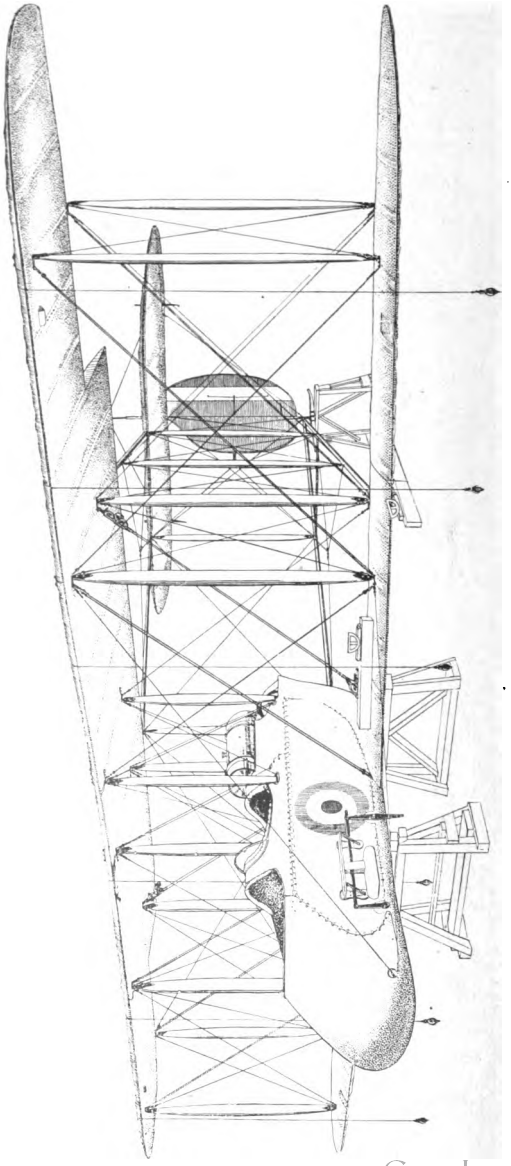
FIG. 6. MACHINE IN FLYING POSITION.



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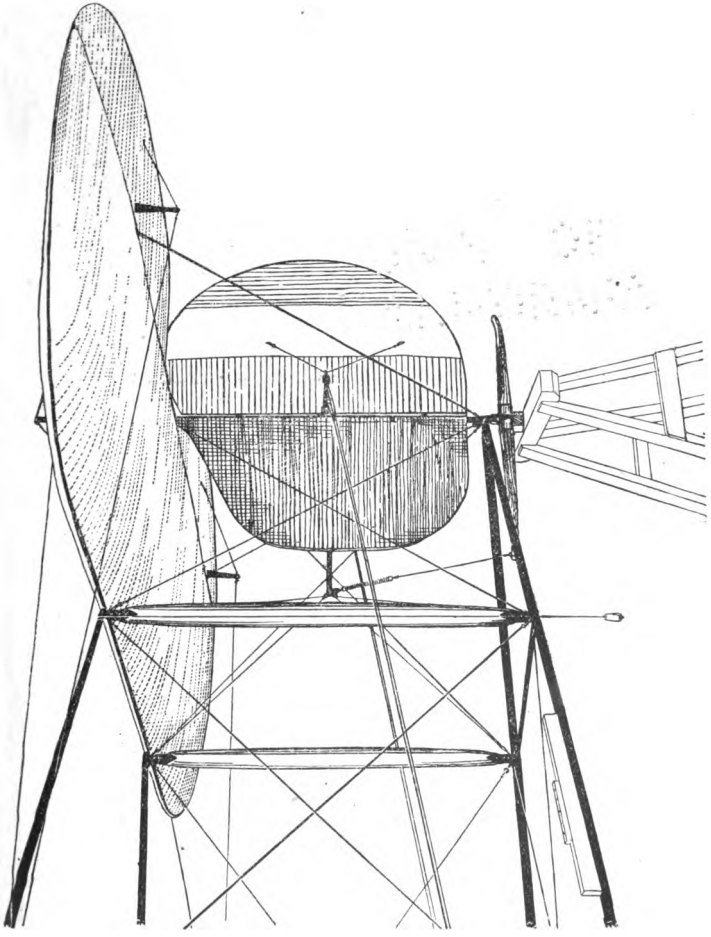
T.5. VICKERS F.B.9. (100 H.P. MONOSOUPAPE).
FIG. 7.



EMPENNAGE.

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RIGGING DIAGRAMS.

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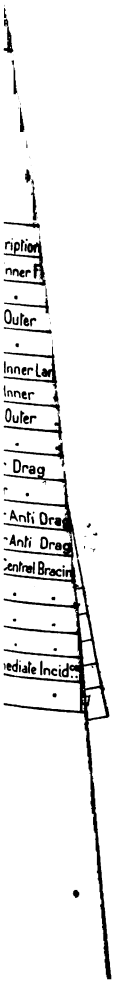

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